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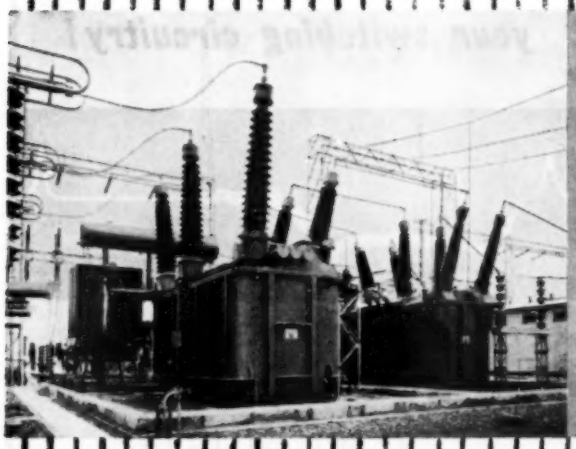
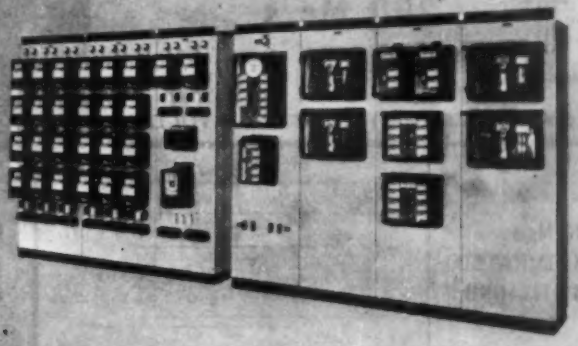
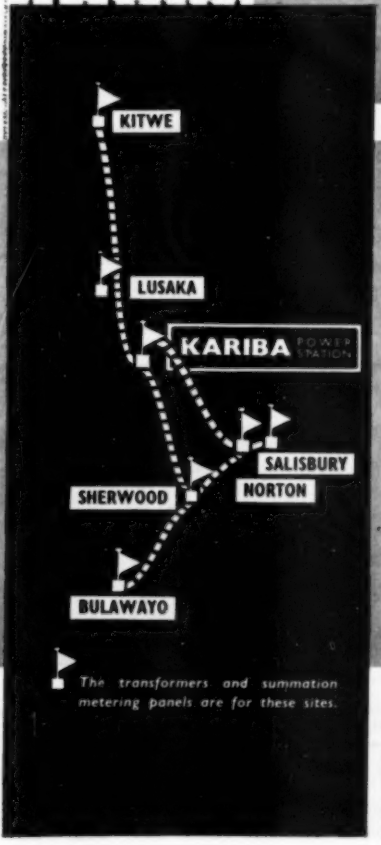


One of the two Ferranti 120,000 kVA 330/234 kV auto transformer and series booster installations at the Kitwe sub-station.

FERRANTI at KARIBA

Ferranti Summation Metering Panels for the Kariba Power Station.





The transformers and summation metering panels are for these sites.

TRANSFORMERS

All the sub-station transformers for the Kariba Hydro-Electric Scheme are being supplied by Ferranti Ltd. They comprise two 120,000 kVA, 330/234 kV 3-phase auto transformers with series boosters, eight 60,000 kVA, 330/88kV and four 60,000 kVA, 330/33 kV 3-phase double wound transformers. The transformer installations at Norton, Lusaka and Kitwe are complete. Work at Salisbury, Bulawayo and Sherwood is well advanced.

SUMMATION METERING

For the same scheme Ferranti Ltd. are supplying Summation Metering Equipment comprising: Precision grade integrating meters, Electro-mechanical summators, Printometer Demand Recorders and Suites of metering cubicles. These equipments will be used to meter six 100 MW generator sets at Kariba Power Station and also the supplies to the Transforming Stations at Kitwe, Norton, Salisbury, Lusaka, Sherwood and Bulawayo.

The consulting electrical and mechanical engineers are Messrs. Merz & McLellan.

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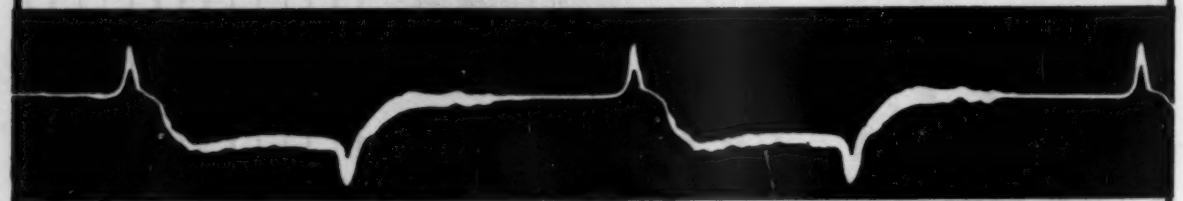

20 μsec or 40 μsec

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BVA SO-12 / JEDEC TO-18

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2G104 GERMANIUM	150 mW	300 Mc/s	15 V
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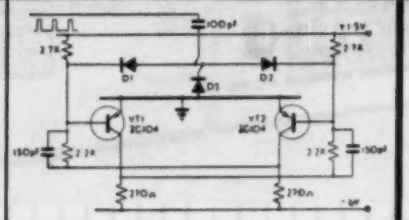
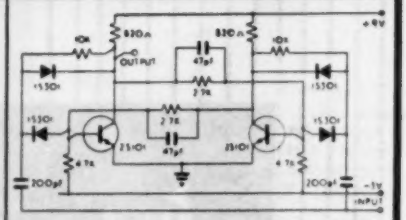
OPERATION UP TO 150°C

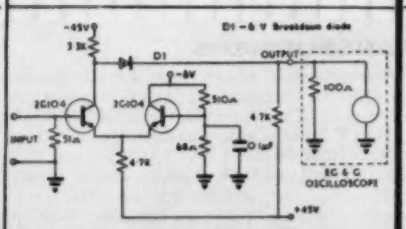
10 Mc/s SATURATED SWITCHING



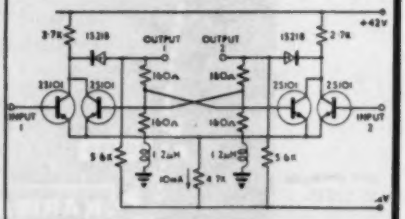
5 Mc/s SATURATED SWITCHING



50 Mc/s NON-SATURATED SWITCHING



25 Mc/s NON-SATURATED SWITCHING



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ELECTRICAL ENGINEERING ABSTRACTS

Volume 63 **JULY 1960** **Number 751**

GENERAL

(For abstracts on circuit theory see also Lines . Networks . Filters)

621.3.01

3918 R.A.A.G. MEMOIRS OF THE UNIFYING STUDY OF BASIC PROBLEMS IN ENGINEERING AND PHYSICAL SCIENCES BY MEANS OF GEOMETRY. Volume II. Edited by K.Kondo.
Tokyo (1958) Gakujutsu Bunken Fukyu-kai [Association for Science Documents Information], 589 pp.

This volume is published for the Research Association of Applied Geometry (R.A.A.G.), University of Tokyo, and contains 28 memoirs, divided into 8 divisions covering applications in different fields. Abstracts of some of the articles will be found in later issues of "Electrical Engineering Abstracts".

621.3.011

3919 THE MAGNETIC C.G.S. UNITS AND THE INTERNATIONAL UNIT SYSTEM. E.Flegler.
Arch. Elektrotech. (Berlin), Vol. 45, No. 1, 1-3 (1960). In German.

The connection between the 3-unit system (c.g.s., i.e., length, mass, time) and the 4-unit systems (addition of an electrical or magnetic unit) is discussed, based on the equation $U = d\phi/dt$, and units such as the Volt, Maxwell ($1M = 10^{-8}$ volt sec), Gauss and Oersted are derived and explained. The main difficulty in the definition of the Oersted is due to different units of current in various systems and to the dimensions of μ_0 and E_0. A.Landman

621.3.011

3920 THE UNITS MAXWELL, GAUSS, OERSTED. J.Fisher.
Arch. Elektrotech.(Berlin), Vol. 45, No. 1, 4-10 (1960). In German

A thorough discussion of the "Oersted problem" (see preceding abstr.) is presented, and it is shown that the rationalized practical system is the logical one, leading to the definition

$$1\ \text{Oe} = (10/4\pi)\ \text{A/cm}$$

The detailed argument is based on the Wallot theorem (Abstr. 4370 of 1952). A.Landman

621.3.011

3921 ELECTRICAL CALCULATIONS. M.Skalicky.
Electrotech. u. Maschinenbau (E.u.M.), Vol. 76, No. 24, 603-8 (Dec. 15, 1959). In German.

Discusses the pitfalls associated with the use of various systems of units for calculations and suggests how these can be avoided. V.G.Welsby

621.3.011

3922 ELECTRICAL UNITS AND STANDARDS. P.Vigoureux.
Proc. Instn Elect. Engrs, Paper 3242, publ. May, 1960 (Vol. 107 B, 235-40).

621.3.011

3923 SOME MULTIHORNED DILEMMAS IN THE MAGNETIC FIELD. F.Avčin.
Trans Amer. Inst. Elect, Engrs I, Vol. 78, 1087-95 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

In spite of the facetious title and a generally light-hearted style, a thorough explanation is given of the various attempts which have been made to derive a satisfactory system of electrical units. V.G.Welsby

621.3.011.1

3924 METHOD OF CALCULATING THE TWO-DIMENSIONAL MAGNETIC FIELD AROUND A CONDUCTOR OF RECTANGULAR CROSS-SECTION AND THE FORCES PRODUCED BY THIS FIELD ON A PARALLEL CONDUCTOR. A.J.Lanzagorta.
Bull. Assoc. Suisse Elect., Vol. 51, No. 4, 137-41 (Feb. 27, 1960). In French.

Examples are given of applications of a suggested method which is quite general but is based on the Biot–Savart law rather than on the use of the fundamental field equations. V.G.Welsby

621.3.011.2

3925 THE DISCHARGE OF AN INDUCTANCE ACROSS A VARIABLE OHMIC RESISTANCE. H.Weh and M.Frister.
Arch. Elektrotech. (Berlin), Vol. 44, No. 6, 355-62 (1959). In German.

Many practical problems require the fastest possible transformation of the magnetic energy in an inductance into heat in a resistance. After working out the ideal solution in which the resistance varies continuously as a function of time and the voltage retains its initial (max.) value throughout the discharge, the more practical solution is discussed where the resistance is a linear function of temperature. The equations are given for this case, and the results compared with those for an ordinary temperature-independent discharge circuit. D.E.Brown

621.3.013 : 621.319.7

3926 ELECTRIC AND MAGNETIC IMAGES. P.Hammond.
Proc. Instn Elect. Engrs, Monogr. 379, publ. May 1960, 8 pp. To be republished in Part C.

The method of images as applied to electrostatic, magnetostatic and electromagnetic fields is investigated. By considering the uniqueness of the field it is shown within what limits the method can safely be used, and rules are given for its use. The application of the method is illustrated by a discussion of the electric field near a cylindrical cathode and the magnetic fields near the end-windings of electrical machines.

621.3.013

3927 THE USE OF COMBINATIVE NUMBERS IN THE STUDY OF ELECTROMAGNETIC FIELDS. M.P.Zlatev.
Onde elect., Vol. 39, 903-12 (Dec., 1959). In French.

Combinative numbers are of the form $Z = mx + ny$ where $mm = m$, $mn = n$, $nm = n$ and $nn = m$. It is shown that this special type of algebra has applications to certain electromagnetic field problems. V.G.Welsby

621.3.013

3928 THEORY OF FERRORESONANCE. J.T.Salihi.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 755-63 (1960) = Commun. and Electronics, No. 46, (Jan., 1960).

It is suggested that explanations of the phenomenon of ferroresonance previously given in the literature are misleading. A simplified explanation is derived by considering an idealized circuit consisting of a reactance with two regions of zero inductance interrupted by a linear region of infinite inductance. V.G.Welsby

621.3.013.1

3929 THE FLUX, THROUGH A GIVEN SURFACE, OF THE MAGNETIC FIELD DUE TO A STRAIGHT CONDUCTOR.
H.H.Wolff.
Arch. Elektrotech.(Berlin), Vol. 44, No. 6, 373-85 (1959). In German.

General formulae are obtained for the flux through polyhedral surfaces parallel to the axis of the conductor. The current is assumed to be d.c., or a.c. at frequencies low enough for phase-shifts in the medium to be ignored. Graphs of various parameters are given to assist in numerical computation. V.G.Welsby

621.3.013.1

3930 THE VOLTAGE APPEARING BETWEEN PROBES APPLIED TO A FLAT CIRCULAR DISK CARRYING A RADIAL ALTERNATING CURRENT. H.H.Wolff.
Arch. Elektrotech. (Berlin), Vol. 44, No. 7, 395-8 (1959). In German.

Reference is made to the similarity between the formula obtained and those given in preceding abstract for the magnetic flux due to a straight conductor. V.G.Welsby

621.3.013.2

3931 FORCES AND FIELD STRENGTHS IN THE ELECTRO-MAGNETIC FIELD. H.Hofmann.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 76, No. 24, 608-13 (Dec. 15, 1959). In German.

Explains the distinction between "direct" and "ponderomotive" forces in the electromagnetic field and relates them to the field vectors. V.G.Welsby

621.3.013.2

3932 CONDUCTING SPHERE IN ALTERNATING MAGNETIC FIELDS. H.Poritsky.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 937-42 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

Gives an analysis of the field disturbance produced when a conducting sphere is placed in a uniform alternating magnetic field. Applications of theory include eddy-current heating and the location of hidden metallic bodies. V.G.Welsby

621.3.017.7

3933 TEMPERATURE PREDICTION IN THERMAL-LAG EQUIPMENT. P.B.Richards.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 462-5 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

Two simultaneous differential equations are derived and solved for the transient temperatures in two heat-generating solids such that both materials store some heat, while some heat is transmitted from one to the other and thence possibly to a third region at a fixed temperature. Conditions are determined under which the temperature will stabilize with time. These equations are used on a digital computer to calculate the temperatures in the field winding and laminations of an a.c. generator bolted to a support, but otherwise insulated from the ambient atmosphere, as in a missile. Measured temperatures agree within 6% with predicted values. The theory can be extended to any number of heat-generating regions, and therefore can be applied to solid-state devices. E.F.Hansford

POWER RESOURCES
PRIME MOVERS

620.9

3934 OPTIMUM UTILIZATION OF THE ENERGY RESOURCES OF AN ISLAND POOR IN FUEL.
J.M.de Gaztelu y Jacome and M.P.Fortuny.
World Power Conference, Canadian Sectional Meeting (Montreal, 1958). 7-11 September, 1958. Section A_1, Section 34 $A_1/7$, 20 pp. In French.

Majorca has an area of 3640 m^2 and a population of 366 000. There are no large rivers. Lignite, of rather poor quality, is the only local fuel and electricity was mainly produced from imported oil and coal. Since 1952, the supply system has been considerably improved and a new thermal power station, suitable for burning either lignite or oil, has been built with two turbo-alternators of 15 000 kW each. To supply the peak load, which is large in relation to the base load, a hydroelectric scheme has been planned in the chain of mountains rising to 1500 metres in the north west of the island. Five reservoirs are to be constructed; the water will be pumped during the night and, after feeding the turbines, will be used for irrigation. The estimated energy is 32.35×10^6 kWh per year and the installed capacity 18 000 kW. The scheme will cost 226×10^6 pesetas. The cost per kWh, taking into account amortization and interest on the capital invested, will be 0.74 pesetas (compared with 1.352 for thermal generation) and against this can be offset the price paid by the users of the water. A further scheme for pumping sea water is being studied and will be put into operation when it becomes necessary. The report contains a map of Majorca and a diagram of the scheme as well as tables and curves showing running costs and operating characteristics.

E.W.Golding

621.039 : 538.3

3935 EXPERIMENTAL MAGNETOHYDRODYNAMIC POWER GENERATOR. R.J.Rosa.
J. appl. Phys., Vol. 31, No. 4, 735-6 (April, 1960).

Electric power is generated by drawing current from a plasma jet moving perpendicular to a 14 000 G magnetic field. A graph shows the voltage, power output, and upstream stagnation pressure as functions of the current drawn. Voltage and pressure vary linearly with current, in agreement with theory. The efficiency of this type of power generation is discussed briefly. O.Penrose

621.224 : 621.316.726

3936 OPTIMIZATION OF THE PARAMETERS OF A HYDRAULIC TURBINE GOVERNOR TAKING ACCOUNT OF THE GRID INHERENT STABILITY FACTOR AND THE TURBINE (EFFICIENCY/OPERATING) DROOP. CASE OF MEDIUM SPECIFIC SPEED FRANCIS TURBINES. G.Ransford and P.Arnaud.
Houille blanche, Vol. 13, No. 3, 205-19, 220-8 (May-June, 1958). In English and French.

After having discussed the inadequacy of methods proposed hitherto for choosing the parameters of turbine governors, a new method of determining the optimum operating values is used, which takes account of the favourable effect of the grid (load/frequency) droop or inherent-stability factor as well as of the adverse effect of the (efficiency/turbine opening) drop. The results are given in graphical form. A numerical application is given.

621.224 : 621.316.726

3937 THE OPTIMIZATION OF HYDRAULIC GOVERNOR PERFORMANCE TAKING ACCOUNT OF THE GRID INHERENT STABILITY FACTOR AND ELASTIC WATER HAMMER EFFECTS. CASE OF PELTON TURBINES.
G.Ransford and J.Rottner.
Houille blanche, Vol. 14, No. 1, 23-37, 38-46 (Jan.-Feb., 1959). In English and French.

The first part of the article deals with the governing of a Pelton turbine taking account of the elastic water-hammer and the grid inherent-stability factor. Within the stable zone, values of the integral typifying the accuracy of governing are determined (in a similar way to a previous treatment dealing with Francis turbines. See previous abstract). The results are given on six diagrams. In the second part of the article, a concrete case is analysed, using the optimum governing parameters determined by the preceding treatment. See also following abstract.

621.224 : 621.316.726

3938 SEPARATE NETWORK FREQUENCY CONTROL BY A PELTON TURBINE WITH OPTIMUM GOVERNOR CHARACTERISTICS. ADDITIONAL STUDY AND CORRECTION.
G.Ransford.
Houille blanche, Vol. 15, No. 1, 53-4, 55 (Jan.-Feb., 1960). In French and English.

Errors made in a previous paper (see preceding abstract) are discussed. G.V.Hargreaves

621.224 : 621-67

3939 SUBMERSIBLE PUMPING PLANT.
H.H.Anderson and W.G.Crawford.
Proc. Instn Elect. Engrs, Paper 3147 U, publ. Nov., 1959 (Vol. 107A, 127-38, 138-40, April, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 608 of 1960.

621.224

3940 THE MIXED-FLOW VARIABLE-PITCH PUMP-TURBINE.
P.Dériaz.
Water Pwr, Vol. 12, No. 2, 49-54 (Feb., 1960).

A review of the advantages of the Deriaz turbine, including satisfactory part-load and overload efficiency. Results of field tests at Adam Beck station are reported and future projects are referred to.
P.Linton

POWER SUPPLY
POWER STATIONS

621.311.1

3941 AN INTRODUCTION TO THE STUDY OF SYSTEM PLANNING BY OPERATIONAL GAMING MODELS.
J.K.Dillard and H.K.Sels.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1284-90 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

An interconnected group of power systems covering Pennsylvania, New Jersey and Maryland have initiated a study of the fundamentals of system planning, development and operation. Some general points are discussed, emphasizing the economic need for planning, outlining the current state of the art, and describing the system studied. The method of attack used, which is to be described in future papers, involves a combination of various techniques: the system is described by mathematical models and Monte Carlo methods are amongst those used to predict future system expansion so that the effect of various planning policies can be evaluated.
G.A.Montgomerie

621.311.1

3942 MATHEMATICAL MODELS FOR USE IN THE SIMULATION OF POWER GENERATION OUTAGES. I. FUNDAMENTAL CONSIDERATIONS.
C.J.Baldwin, D.P.Gaver and C.H.Hoffman.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1251-8 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

To carry out the investigation outlined in the preceding abstract, it is necessary to have mathematical models of various parts of the power system and this paper is concerned with that part of the model used to represent one of the random events, power generation outages. There is a discussion of methods previously used, in particular that of Calabrese which makes use of the probability q of a particular unit being out of action. This method and its derivatives in general yield no information about the duration of individual breakdowns, are not easily correlated with actual loss of load dependent on whether or not the breakdown is at a peak period, take no account of dispersion of actual performance about average, and do not recognise the variability in exposure of individual units in a group. A new model is proposed in which for a single unit the lengths of successive up periods are statistically independent random quantities all coming from the same statistical population and the lengths of successive down periods are similarly independent random quantities independent also of the up-period lengths. The model is then simplified by assuming that: (a) if a unit is up at time t, the probability that it goes down in the next short period is adt, where a is the constant failure rate; and (b) by assuming also a constant repair rate, b. This model assumed that the probability of unit failure is independent of the age of the unit.
G.A.Montgomerie

621.311.1

3943 MATHEMATICAL MODELS FOR USE IN THE SIMULATION OF POWER GENERATION OUTAGES. II. POWER SYSTEM FORCED-OUTAGE DISTRIBUTIONS.
C.J.Baldwin, J.E.Billings, D.P.Gaver and C.H.Hoffman.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1258-72 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

Outage histories for a 10 year period for thirteen high-pressure steam-generating units on the system of the Public Service Electric and Gas Company, Newark, New Jersey are used to establish the failure rates. These differ, depending on whether the unit is a recent installation or not, but a composite equivalent failure rate can be worked out by a method described. For a single boiler unit the failure rate is 0.0419 and for a twin boiler unit 0.0576 per day. The probabilities of the failure being complete or partial are also described, and appendices discuss some of the statistical considerations involved.
G.A.Montgomerie

621.311.1

3944 ELECTRICITY IN YUGOSLAVIA. A REVIEW OF POST-WAR DEVELOPMENTS. D.Anley.
Elect. Rev., Vol. 166, No. 13, 574-7 (March 25, 1960).

Details are given of the major hydroelectric projects in Yugoslavia and mention is made of the scheme on the River Trebisnjica which is expected to produce about 2.5×10^9 kWh per annum. Brief reference is made to steam power stations and to the electricity supply industry in general.
Central Electricity Generating Board Digest

621.311.153

3945 THE BALANCING OF THREE-PHASE NETWORKS BY MEANS OF ADDITIONAL LOADS. G.Gotter.
Rev. Electrotec., Vol. 45, No. 11, 415-24 (Nov., 1959). In Spanish.

After a summary of the theory of symmetrical components, it is shown how an unbalanced 3-ph. load can be balanced by the addition of 1, 2 or 3 impedances.
R.G.Jakeman

621.311.161

3946 PROBLEMS OF THE DISTRIBUTION OF LOAD BETWEEN COLLABORATING POWER STATIONS.
H.Buhl.
Ingeniøren B, Vol. 69, No. 7, 221-5 (April 1, 1960). In Danish.

The most economic distribution of load between two generating sets in a single power station is first examined. If Pa and Pb are the respective loads in MW and Ka and Kb are the power costs, then optimum distribution is obtained when the differential prices per kWh, dKa/dPa and dKb/dPb are equal. The same principle holds for power stations working in a group, but here transmission losses have to be taken into account. If λ = dK/dPa/(1-dPr/dPa) has the same value for each of the stations, Pr being the total transmission loss, then optimum load distribution results. The principles of load dispatching and the operation of the load dispatcher's control table are briefly considered.
G.N.J.Beck

621.311.161

3947 EQUIVALENT GENERATOR IN THE STUDY OF STATIC STABILITY. F.Manea.
Rev. d'Electrotech. et d'Energetique, Vol. 2, No. 2, 221-6 (1957). In French.

The study of the static stability of a power system may be materially facilitated by substituting an equivalent generator for a group of generators working in parallel. Under certain simplifying conditions, e.g. that the active power values and the angles between electromotive forces remain constant, formulae are derived for determining the short-circuit current, its phase angle and other characteristic data of the equivalent generator. As examples such a generator is calculated equivalent to a generator with local load, to several generators and to one operating in the saturated state. A numerical example is given and the results of the calculation are tabulated and discussed.
R.Neumann

621.311.17

3948 DISTRIBUTION OF ELECTRICITY IN AN ALL-ELECTRIC COALFIELD. J.B.McPherson.
Mining elect. mech. Engr, Vol. 40, 299-304 (April, 1960).

In 1947 the colliery load in the vicinity of Edinburgh was largely met by small generating plants of up to 5 MW installed at the various sites. The arrangements have now been rationalized, no private generating plant is operated and the entire load is met from a 33 kV distribution system. An account is given of the layout of the system and the methods of protection, control, metering and operation.
M.Rathbone

621.311.2

3949 PUMPED-STORAGE STATIONS AND THEIR INTEGRATION INTO THE LARGE GRIDS SUPPLIED BY NUCLEAR POWER STATIONS. C.Jaeger.
Bull. Soc. Roy. Belge Elect., Vol. 75, No. 4, 287-94 (Oct.-Dec., 1959). In French.

A review of the economics of combining base load and pumped storage, using the Soschinski system load curve. The capital costs of various types of station are quoted and it is suggested that a river with several stations in series could be used for pumped storage by employing reversible pump-turbines.
P.Linton

621.311.2

3950 POWER STATION HEAT CYCLES. P.J.Cameron.

Elect. Rev., Vol. 166, No. 15, 675-80 (April 18, 1960).

Compares the heat cycle of the turbo-alternator/boiler unit of the modern conventional power station with that used in a turbo-alternator/reactor unit of a nuclear power station in which the graphite-moderated gas-cooled reactor is the heat source. The methods used to make progress in conventional power station heat-cycle practice are reviewed and the reasons for the adoption of these methods are indicated. A possible heat cycle is illustrated for a nuclear power station of 150 MW (sent out) electrical capacity "fired" by a graphite-moderated gas-cooled reactor and attention is drawn to the main factors affecting the choice of overall heat-cycle operating conditions.

621.311.21

3951 SEPARATE-NETWORK FREQUENCY CONTROL BY MEDIUM n_s FRANCIS TURBINES WITH OPTIMIZED GOVERNOR PARAMETERS. G.Ransford.

Houille blanche, Vol. 15, No. 1, 41-7, 48-52 (Jan.-Feb., 1960). In French and English.

A summary is given of frequency-control data for medium specific-speed Francis turbines for the use of designers. The effect of grid inherent-stability and runner efficiency droop is discussed. Optimum governor parameters and corresponding response curves after sudden application of load are given for 25 possible combinations. G.V.Hargreaves

621.311.21 : 621.313.322-82

3952 GENERATOR/MOTOR PROBLEMS IN PUMPED-STORAGE INSTALLATIONS. J.H.Walker.

Proc. Instn Elect. Engrs, Paper 2853 S, publ. Feb., 1959 (Vol. 107A, 157-65, 165-71, April, 1960).

Republication, with discussion of the paper already abstracted as Abstr. 1903 of 1959.

621.311.21

3953 A HYDROELECTRIC POWER STATION FOR A PEAK LOAD OF 1000 MW. O.K.M.Uitting.

Siemens-Z, Vol. 34, No. 5, 281-7 (May, 1960). In German.

By partly filling the Qattara depression (area 4630 sq. miles) with water from the Mediterranean, it would be possible to generate two thousand million kWh per year. Proposals have been made for the provision of a daily storage reservoir and for the installation of generators with an output of 1000 MW to supply the peak load in the Nile Valley some 110 miles away. The favourable effect which the "Qattara Sea" will have on the climate, ground water level and vegetation will make large plains and desert regions habitable.

621.311.21

3954 BINGA POWER STATION (PHILIPPINES). G.Magnusson.

Tekn. T., Vol. 90, No. 13, 331-7 (March 25, 1960). In Swedish.

A second hydro-electric station has been built, with Swedish aid, on the Agno river in the island of Luzon. The output will be 100 MW; the head is 160 m. Full details are given of the civil engineering work. The rock-fill dam is 103 m high, has a volume of 2×10^6 m^3, and is constructed mainly of rock, blasted out. The machine hall is of special interest, being 70 m below the earth surface, with which it is connected by two vertical shafts. The discharge tunnel is 2 km long and has a 40 m^2 section. G.N.J.Beck

621.311.22

3955 PEAK-LOAD OPERATION OF STEAM TURBINES. P.F.Carson.

Elect. Rev., Vol. 166, No. 13, 563-9 (March 25, 1960).

In order to develop techniques which are technically and economically a programme of testing different types of steam-turbine installation has been undertaken and and has covered the range of steam conditions from 600 lb/in^2/850° F to 1500 lb/in^2/1050° F. A brief description is given of the two-shift operating tests carried out on a 60 MW/1500lb/in^2/1050° F unit at Stourport power station. Data from the tests are tabulated.

Central Electricity Generating Board Digest

621.311.22

3956 POWER STATION UNIT PLANTS FOR 600° C LIVE STEAM TEMPERATURE — THE 80-MW UNIT BLOCK IN NEUHOF POWER STATION. E.Stange.

Elektrizitätswirtschaft, Vol. 58, No. 21, 729-36 (Nov. 5, 1959). In German.

An illustrated description of this power station of the Hamburg electricity works. The reasons are given why 600° C was chosen as live-steam temperature. It was specially required that the set should allow of frequent restarting after short intervals and that it should be brought up to full output after about two hours. The parts of the equipment subject to high temperature are made of austenitic steels. The single-shaft-turbine consists of a h.p., a m.p. and a double-flow l.p. stage coupled to a hydrogen-cooled alternator of 101 MVA apparent power. Operational experience, particularly as regards the starting and stopping of the set, is given. The fluctuations in the price of austenitic steel must be taken into consideration when deciding upon the live-steam temperature of new plant. Graphs showing the mutual interdependence of fuel price, price of the set, annual duration of utilization and price of austenitic steel are given.

R.Neumann

621.311.23

3957 PEAK LOAD GAS TURBINE WITH AIR STORAGE. B.Wood and T.F.Wick.

Engineer, Vol. 209, 418-21 (March 11, 1960).

It is proposed to store compressed air in a natural or artificial cavern; the compressor would operate during low-load periods and a gas turbine with oil as fuel would provide peak-load output. Capital cost is estimated at £24–36 per kW for a 80 MW plant running 240 hours per annum, thus making it competitive with hydraulic pumped-storage. P.Linton

621.311.25

3958 SMALL NUCLEAR POWER STATIONS — BY BRITAIN. Engineering (London), Vol. 189, 517-22 (April 15, 1960).

Descriptions are given of small stations ranging in capacity from 11 to 60 MW. Types considered include various pressurized-water, high-temperature gas-cooled, organic (terphenyl)-moderated, boiling-water, and steam-cooled heavy-water reactors. Eight different designs are described and tables are given showing full data on the mechanical, electrical, economic and other characteristics of the reactors and their associated equipment.

621.311.25

3959 FUEL AND HEAVY WATER SUPPLY FOR SWEDISH NUCLEAR POWER INSTALLATION. D.Jungnell and R.Edman.

Tekn. T., Vol. 90, No. 14, 349-54 (April 1, 1960). In Swedish.

Development in Sweden has concentrated on reactors with heavy water as moderator and natural uranium as fuel. The annual demand in tons for fuel and heavy water for a nuclear power station with 500 MW output/year over 10 years (thereafter 1000 MW/yr) is shown graphically. Figures are given for both heavy-water boilers with natural U and light-water boilers with 1.5% U^{235} enriched U. A survey is given of production and costs of natural U, enriched U, and heavy water. G.N.J.Beck

621.311.6 : 621.395.7

3960 POWER SUPPLY SYSTEM FOR MANNHEIM'S COMMUNICATIONS BUILDING. T.Fried and K.Braun.

Siemens-Z., Vol. 34, No. 5, 307-10 (May, 1960). In German.

A new full automatic power supply system has been installed for powering the telephone, telegraph and radiocommunication equipment at the Mannheim sectional office, which has been considerably expanded in recent years. The operating principle of the power supply system and the functions of the various items of equipment are described.

621.311.6 : 621.383

3961 SOLAR CELL POWER SUPPLIES FOR SATELLITES. R.M.Acker, R.P.Lipkis, R.S.Miller and P.C.Robison.

Electronics, Vol. 33, No. 11, 167-72 (March 11, 1960).

The construction and the efficiency of silicon solar batteries is described. Four paddles, each containing 2200 cells, are fixed to each satellite. The optical, electrical and mechanical design criteria of these paddles are discussed. The efficiency of each cell is about 8% and, in orbit about the moon, about 30 W is provided by the paddles. D.J.Oliver

621.311.6 : 629.13

3962 APPLICATIONS OF ELECTRICITY IN AIRCRAFT. V.A.Higgs.

Proc. Instn Elect. Engrs, Paper 3198, publ. April, 1960 (Vol. 107A, 197-201).

ELECTRIC MACHINES

621.313.1 : 621.314.2

3963 COOLING PROBLEMS. C.Rossier.

Bull. Assoc. Suisse Elect., Vol. 51, No. 6, 246-9 (March 26, 1960). In French.

A survey in general terms of methods of cooling used for rotating machines and for transformers, indicating the most economical and convenient system in a particular application. The effects on plant layout are also considered. M.R.Dickson

621.313.1

3964 OVERHEATING OF MOTORS. J.L.Watts.

Elect. J., Vol. 164, No. 8, 493-5 (Feb. 19, 1960).

The useful life of an electric motor will be considerably reduced if it is allowed to run under conditions that increase its temperature to an abnormal value. Such conditions may arise due to inefficient cooling, mechanical overload, non-completion of starting, wrong connections, effects of unequal voltages. The symptoms are summarized in tabular form. G.V.Hargreaves

621.313.1

3965 MEASUREMENT OF MOMENT OF INERTIA. N.Selseth.

Elektrotek. T., Vol. 73, No. 10, 165-8 (April 5, 1960). In Norwegian.

Bregstad's and Arnold la Cour's method for measuring the moment of inertia of the rotating parts of an electro-mechanical system suffer from the drawback that the assumption they make, namely, that the frictional torque is constant, cannot be verified. The method described, which closely resembles that of Arnold-la Cour, overcomes this objection. Weights are used to accelerate the rotating masses from the stationary state and the times of drop of the weights are measured. The relation $1/T_m^2 = f(G)$ is plotted (T_m being the mean of 10 readings for a given weight G). The relation is linear, as shown theoretically, the intercept which the straight lines makes with the G-axis giving the value G_f, the frictional force required. The torque is given by $M_f = G_f r$, r being the radius of the rotating member. The statistical error of the method is worked out in detail. G.N.J.Beck

621.313.1

3966 THE ELECTRICAL MACHINE — A GENERAL APPROACH. C.E.Moorhouse.

Elect. Engr (Melbourne), Vol. 36, No. 8, 53-60 (Nov. 10, 1959).

General schemes of machine analysis as developed by Kron and others suffer from the drawback of making considerable mathematical demands on the individual who attempts to master them. The method of approach adopted here brings out the fact that the various individual rotating electrical machines can be examined generally in the light of the behaviour of a relatively small number of components without recourse to the advanced mathematics which has usually been used. G.V.Hargreaves

621.313.12

3967 RELIABILITY ANALYSIS FOR AIRCRAFT GENERATORS. J.T.Duane and L.J.Yeager.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 426-34 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

Discusses reliability evaluation, with particular attention paid to rotating machinery in aircraft and missiles, which is required to complete repetitive missions of specific length during a relatively long service life. Emphasis is placed on wear characteristics such that the likelihood of failure varies with the length of time which the equipment has been in service. J.T.Hayden

621.313.12 : 621.316.973

PROTECTION OF GENERATORS AGAINST DOUBLE EARTH FAULTS. See Abstr. 3372

621.313.322

3968 CONSTANT-FREQUENCY A.C. POWER USING VARIABLE GENERATION. R.D.Jessee and W.J.Spaven.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 411-18 (1959) = Applic. and Industr., No. 46 (Jan. 1960).

A scheme is proposed in which the variable-frequency output from a conventional a.c. generator is supplied to the load via a servo-controlled frequency-changing switching device. The load phases are connected to each phase of the generator output in turn for a prescribed time to give load phase-voltages which are predominantly sine waves with considerably high-frequency harmonics superimposed. The fundamental frequency is equal to the difference between the generator and switching frequencies, the frequency of the generator being chosen to be several times that of the load. The method of frequency conversion for a 6-phase generator supplying a 3-phase load is given in detail with outline circuit, waveform and block diagrams. Variations in the switching frequency convertor, which usually comprises semiconductor devices, are suggested. An appendix deals with the calculation of the form of the output voltage, neglecting the time to switch from one phase to the next; commutation is covered in the discussion. J.T.Hayden

621.313.322-81

3969 CONTROLLED STARTING TESTS ON 60 MW TURBO-ALTERNATORS. F.L.Tombs.

G.E.C. J., Vol. 26, No. 4, 138-42 (Autumn, 1959).

In order to cater for the large difference between the base-load and peak-load of the British national load curve, a large amount of generating plant is shut down overnight and brought back into service during the day. It is desirable to run up and load at the maximum practical rate to improve the overall system efficiency and to match the rapid load increase around 8 a.m. Care must be taken to control the rate of heating, in order to avoid unacceptable stressing of the turbine casing and transient thermal bending of the rotor. Tests after shutdowns of 6 hr (warm starts) and 60 hr (cold starts) were carried out on two 60 MW turbo-alternators at Hams Hall "C" and at Poole generating stations. The tests are described in detail with curves showing steam temperature, speed, load, rate of change of casing temperature, horizontal eccentricity, axial differential expansion, and metal temperature against time. H.Sterling

621.313.322-81 : 621.316.91

3970 FIELD SUPPRESSION OF TURBO-ALTERNATORS. J.R.Hill, A.Hunt, W.J.Joyce and D.H.Tompsett.

Proc. Inst Elect. Engrs, Paper 3161 S, publ. Nov., 1959 (Vol. 107A, 141-51, 151-6, April, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 46 of 1960.

621.313.33 : 681.142

COMPUTER VALUATION OF AIRCRAFT HIGH-TEMPERATURE A.C. ELECTRICAL SYSTEM DESIGNS. See Abstr. 3684

621.313.333

3971 LOAD-BALANCE AND STATIC STABILITY OF THE SINGLE-PHASE ELECTRIC SHAFT. A.K.Goswami.

Arch. Elektrotech. (Berlin), Vol. 44, No. 5, 297-305 (1959). In German.

The steady-state behaviour of a single-phase electric shaft, consisting of two identical three-phase induction machines with slipring rotors, is investigated with the help of symmetrical components. Equations for load-balance and static stability are developed. Test results including oscillograms are presented and show reasonable agreement with calculated values. It is concluded that single-phase selsyns have advantages over three-phase selsyns for torque transmission at standstill. H.Sterling

621.313.333 : 681.142

3972 A COMPUTER METHOD OF DETERMINING THE VARIATION OF INDUCTION MOTOR MAGNETISATION WITH SPEED. B.J.Chalmers.

Beama J., Vol. 67, No. 1, 29-31 (Feb., 1960).

The reduction of the flux-density in a polyphase induction motor caused by the primary leakage, and the consequent variation with load of the flux-density and magnetizing current, are almost always ignored in design calculations. By using a computer, it is feasible to include these effects and to use a more exact equivalent circuit on which to base the calculations. A block diagram of an appropriate

programme is given, and sample calculations are presented in graphical form as the locus of the magnetizing-current vector as the slip varies from unity to zero and as a complete locus diagram of stator, rotor and magnetizing currents as the slip varies over the same range. G.A.Montgomerie

621.313.333

3973 STARTING TORQUE AND STARTING CURRENT OF ASYNCHRONOUS MACHINES WITH DOUBLE-CAGE ROTORS AND SIMILAR ROTOR TYPES. H.Weh.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 24, 855–60 (Dec. 11, 1959). In German.

Simplified equivalent circuits for various types of double- and triple-cage induction motors are used to develop equations for starting torque and starting current. These equations use ratios of various cage resistances and reactances. Families of curves are produced which help in the preliminary design of double-cage machines by showing the influence of the resistances and reactances of the cages on the starting performance. A bibliography is included. H.Sterling

621.313.333 : 621.316.718.5

3974 BRUSHLESS VARIABLE-SPEED INDUCTION MOTORS USING PHASE-SHIFT CONTROL.
F.C.Williams, E.R.Laithwaite, J.F.Eastham and W.Farrer.
Proc. Instn Elect. Engrs, Paper 3263 U, publ. May, 1960, 9 pp. To be republished in Vol. 108A (1961).

Describes a method of "pole-stretching" for induction machines in which part of the stator windings are fed directly from the mains supply and part from phase-shifting transformers. Variation of the angle of phase-shift enables continuous speed control to be effected. An experimental machine is described, the test results from which demonstrate that speed control with constant efficiency can be obtained over a speed range of 1.5 : 1. The limitations on the range of such machines imposed by the necessary condition that the stator be discontinuous are discussed, and a method of extending the speed range is then described. Machines of this type may be designed to run with a number of discrete synchronous speeds, in which case no phase-shifting transformers are necessary and speed change is effected by external switches only. The historical link between this type of machine and the spherical motor is outlined.

621.313.333

3975 AIRCRAFT SECONDARY POWER GENERATOR WITH DIRECT COMPENSATION FREQUENCY CONTROL.
L.J.Johnson and S.E.Rauch.
I.R.E. Trans Compon. Parts, Vol. CP-6, No. 4, 259–63 (Dec., 1959).

The variable-speed constant-frequency alternator system provides accurate frequency control independent of the shaft speed. The method employed is completely electrical in contrast with the more conventional mechanical speed-control systems. The principle of operation depends upon a constant angular velocity magnetic field in the alternator armature, the angular velocity being the vector sum of the mechanical velocity of the shaft and the velocity of an electromagnetic rotating field induced by the excitation of a polyphase field winding. The polyphase field winding is driven by a variable-frequency polyphase exciter, its frequency being directly proportional to the speed deviation from synchronous speed of the alternator rotor and shaft. The frequency control system described is the open-loop type and, as such, accomplishes absolute frequency control with no errors arising from load or speed transients. An experimental brushless, constant-frequency 3 ph. alternator is discussed.

621.313.361

3976 SERIES MOTORS IN DOMESTIC APPLIANCES. D.J.Pitstow.
Engineering (London), Vol. 189, 532–4 (April 15, 1960).

A review of some of the major applications of series motors in the domestic appliance field. Explains reasons for using this type of motor (e.g. relatively small, low cost, wide range of speed, high power-to-weight ratio, suitable for either d.c. or a.c.) and lists disadvantages of the motor(e.g. noisy operation, high brush wear, interference with radio and television). Electrical methods of speed control are summarized. Considerations involved in the selection of motors for individual domestic appliances, such as vacuum cleaners, spin dryers, washing machines, hair dryers, sewing machines and food mixers are dealt with separately. Portable-tool motor design is also discussed with the attendant difficulty of providing double insulation. H.A.Miller

621.313.391

3977 A SOLID ROTOR A.C. GENERATOR FOR HIGH-TEMPERATURE ELECTRICAL SYSTEMS. J.T.Bateman.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 400-5 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

Describes the construction and characteristics of a generator combining the configurations of a homopolar inductor generator and Lundell generator for use in aircraft, with the object of obtaining greater reliability, lighter weight than with either of the separate types and performance characteristics which compare favourably with conventional generators. A list of references and a discussion are included. Insulation and bearing details are omitted. J.T.Hayden

TRANSFORMERS

621 314.2

3978 POWER TRANSFORMERS. COMMENTS ON B.S. 171: 1959 AND CODE OF PRACTICE C.P. 1010 (1959). W.S.Lovely and R.S.Orchard.
Elect. Rev., Vol. 166, No. 10, 451-4 (March 4, 1960).

A critical appraisal of the features in the latest issue of the British Standard for power transformers which are new or changed in relation to the earlier 1936 issue. The article explains how the additions and changes have been made and how they are to be applied in practice. Important changes are insulation levels with associated voltage tests and average cooling temperature conditions.

621.314.2

3979 THE INFLUENCE OF NEUTRAL CONNECTED REACTORS ON THE OVERVOLTAGE STRESSES AT THE TRANSFORMER NEUTRAL. D.Vaida and T.Taiti.
Acta tech. Hungar., Vol. 27, No. 3-4, 297-321 (1959). In Russian.

Investigates the dangers of impulse breakdown in transformers and reactors when the latter are inserted in the neutral of a transformer to limit the fault current of the system. A method of calculation is given which enables the form of the voltage waves, following an impulse shock, to be made. This theoretical approach was confirmed by measurements at a lower voltage. The investigation enables the maximum stress at the neutral to be simply calculated taking into account the various circuit elements. The use of overvoltage arresters is suggested as the most appropriate method for protecting the neutral point. J.S.Wilson

621.314.2

3980 DETERMINATION OF SHORT-CIRCUIT FORCES ON TRANSFORMER WINDINGS. P.Ignacz.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 23, 844-50 (Dec. 11, 1959). In German.

Stresses the importance from the point of view of safety of having an accurate method of assessing the magnetic forces acting on a transformer under short-circuit conditions and claims that most published methods do not fully take into account the complex forces acting on the transformer windings or are too complicated for practical application. Since conditions are not uniform throughout the winding it is necessary to treat each coil, and in some cases each turn, individually—end turns are shown to be particularly vulnerable and to require special treatment. A mathematical procedure is set out which is claimed to overcome these difficulties and to produce results which compare very well with those obtained in tests on full size transformers. D.R.Way

621.314.2

3981 PROBLEMS OF THE INSULATION OF TRANSFORMERS FOR VERY-HIGH VOLTAGES (380 TO 500 kV). W.Rabus.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 2, 34-41 (Jan. 18, 1960). In German.

Very-high-voltage transformers with earthed neutral are less heavily stressed than transformers of lower voltage earthed through arc-suppression coils. Protection of lines against direct lightning strokes and the use of non-restriking circuit-breakers has greatly reduced the danger from incoming surges and tests in several countries have shown that internal over-voltages when switching unloaded transformers are less severe than had been thought. A reduction in impulse-voltage test-levels is suggested with the omission of chopped-wave tests but only for these very-high voltages. A.P.Wilmshurst

621.314.2

3982 THE CONTROL OF THE HEATING AND SHORT-CIRCUIT PROBLEMS IN LARGE TRANSFORMERS. A.Meichinger.
Elektrotech.Z. (E.T.Z.)A, Vol. 81, No. 2, 47-52 (Jan. 18, 1960). In German.

A detailed examination into the means to be taken to increase the life of the windings by avoiding high thermal stresses and particularly hot spots. The effect of deterioration of the insulation on the resistance to s.c. stresses is also discussed. A bibliography and a discussion are added. R.G.Jakeman

621.314.2

3983 THE REDUCTION, DISSIPATION AND UTILIZATION OF HEAT LOSS IN TRANSFORMERS. V.Aigner.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 7, 145-54 (April 4, 1960). In German.

Describes improved methods of construction of power transformers which have enabled iron losses to be halved and copper losses to be reduced by approximately 10% since 1944. The use of low viscosity oil, new types of cooling fins and forced draught cooling are discussed in detail. The economics of utilization of waste heat for space heating are considered and details are given of a transformer and heat-exchanger installation which is used for heating a multi-story building. T.R.Foord

621.314.2 : 621.316.722

3984 OPERATION OF ON-LOAD TAP CHANGERS IN THE CASE OF TRANSFORMERS CARRYING SHORT CIRCUIT CURRENT. H.Manzinger.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 4, 69-78 (Feb. 15, 1960). In German.

The ability of a tap-changer to withstand short circuit can vary considerably with different tap-changers of the same rating. The behaviour of the flag, assymetrical penant and multi-stage resistor type are discussed under normal and short-circuit conditions and in relation to the transition resistors. The arrangement of the moving parts and energy storage also influences the overall performance in requiring a suitable change-over-time. Curves and vector diagrams illustrating the relation between various electrical quantities and the magnitude of short-circuit current are given. The probability of satisfactory operation under short-circuit conditions can be greatly increased, without additional expense, by selecting a two or more step system, coordination of transition resistors and selection of switching mechanism for which overall time of operation of main and resistor contacts does not exceed 20 ms. W.J.Grek

621.314.2

3985 MAGNETIC NOISE IN THREE-PHASE CORE-TYPE TRANSFORMERS. H.Jordan.
Elektrotech. Z. (E.T.Z.)A, Vol. 81, No. 3, 97-101 (Feb. 1, 1960). In German.

After a short explanation of the mechanism of the production of noise, the technical questions are formulated. The magneto-striction extensions are co-ordinated with the exciting forces. By dividing up the system of forces, it is possible to calculate the unavoidable distortions at double frequency on the basis of the theory of the strength of materials. The higher harmonics of the magneto-striction spectrum can produce special frequencies and core shapes which can be explained by means of mechanical equivalent diagrams. A bibliography and a discussion are added. R.G.Jakeman

621.314.2

3986 EXTRA HIGH VOLTAGE TRANSFORMERS. A.J.Haselfoot.
Hawker Siddeley tech. J., Vol. 1, No. 4, 16-21 (Spring, 1960).

A review of some particular design, manufacturing and testing problems associated with transformers of 275 kV and higher voltages. M.R.Dickson

621.314.2

3987 DYNAMIC CONDITIONS AND THE EQUIVALENT CIRCUIT OF A DIFFERENTIAL TRANSFORMER TRANSMITTER. A.L.Abrukin.
Priborostroenie, 1959, No. 6 (June). In Russian. English translation in: Instrum. Constr., 1959, No. 6, 14-16 (June).

Discusses the dynamic errors of a differential transformer due to the induced e.m.f. A.O.Stanesby

621.314.2

3988 DETERMINATION OF COPPER LOSSES IN TRANSFORMERS. H.Pöhnl.
Österr. Z. ElektWirtsch. (Ö.Z.E.), Vol. 13, No. 1, 9-12 (Jan., 1960). In German.

Sets out a method of calculating the copper losses in transformers operating under varying load conditions, given the transformation ratio, the load factor, and other basic transformer data only. The method involves a minimum of calculation and yields results accurate to within 1.5% for copper loss and 0.6% for total losses. It is possible to read off from the given diagrams the relation between losses and load factor, related to full load losses. It is possible also to distinguish between peak losses and steady losses if desired. D.R.Way

621.314.2 : 621.318

3989 INFLUENCE OF COPPER ON THE WATT LOSSES OF TRANSFORMER STEEL. S.Kronmarck.
Technik, Vol. 14, No. 4, 274-6 (April, 1959). In German.

An illustrated report on extensive tests made to determine whether a strict limitation of the Cu-content of transformer sheets is necessary. Three different charges were melted in a basic 10 t arc furnace, one of the charges being of particularly low Cu-content. Cold-rolled 0.35 mm band was produced from all three charges. The tests showed that there is no point in limiting the Cu-content to less than 0.20%. The watt losses and coercive forces of the different test specimens are tabulated. R.Neumann

621.314.2 : 621.313.1

COOLING PROBLEMS. See Abstr. 3963

621.314.2 : 621.317.333.4

USE OF NOISE MEASUREMENTS FOR THE DETERMINATION OF THE CAUSES OF INTERNAL IONIZATION IN HIGH-VOLTAGE TRANSFORMERS. See Abstr. 3400

621.314.212

3990 THE EFFECT OF COOLING AIR TEMPERATURE ON THE INTERNAL COOLING OF OIL-FILLED TRANSFORMERS. H.Reinke and L.Zinke.
Elektrotech. Z. (E.T.Z.)A, Vol. 80, No. 23, 812-16 (Dec. 1, 1959). In German.

The effects of the higher temperature of cooling air and corresponding reduction in relative viscosity of oil on cooling of transformers are described. Results of experiments on distribution transformers of conventional construction show that: (1) For every 10° increase of temperature of the cooling air, the temperature rise in the winding drops between 0.7 – 1.5°, and between 0.5 – 1.0° in the upper layer of oil: (2) using lighter oil with viscosity about 20% lower than normal grade, the winding temperature drops by 2.4° and that of the upper layer of oil by 1° with the same cooling air temperature. Basic principles of heat transfer in transformers and experimental procedure are discussed in some detail. Empirical relations for application of the results of research into practical use are also given. W.J.Grek

621.314.222

3991 CAPACITIVE VOLTAGE TRANSFORMERS. H.Kahnt.
Elektrotech. Z. (E.T.Z.) B, Vol. 11, No. 12, 476-9 (Dec. 21, 1959). In German.

The type of voltage transformer discussed is that described by P.Hochhäusler in 1938, in which an auxiliary double-wound transformer is connected across the l.v. capacitor of the capacitive divider, and its primary circuit tuned to resonance by a gapped iron-cored, series-connected inductor. The burden is connected across the transformer secondary. Three types of h.v. capacitor in outdoor use are illustrated. By inserting an inductor (~ 12 mH) between the l.v. capacitor and earth, the h.v. capacitor can, in addition to its normal function, be used for carrier-frequency signal injection into the h.v. line. A basic circuit for both purposes is given, and overvoltage protection of the apparatus discussed. The internal and external construction of the voltage transformer is described, and its performance in service compared with that of inductive voltage transformers. A curve showing relative cost against voltage is given for both types; for 125 kV, costs are equal; for 400 kV, the capacitive type is 40% cheaper. C.F.Pizzey

621.314.222

3992 PROGRESS IN THE FIELD OF CAPACITIVE VOLTAGE TRANSFORMERS. G.A.Gertsch.

Scientia Electrica, Vol. 6, No. 1, 1-27 (March, 1960). In German.

The capacitive voltage transformer consists of a high voltage capacitive divider feeding a voltage measuring transformer. Equivalent circuits and vector diagrams are derived from which are calculated measurement errors due to the burden, frequency, voltage and temperature. Attention is drawn to ferro-resonant effects which may follow certain transient states of the circuit. These take the form of either subharmonic or relaxation oscillations. Methods of suppressing stable oscillations include spark-gap switching and resistive damping, the latter however being detrimental to the accuracy of measurement. Circuit conditions leading to the appearance of ferro-resonance are detailed. Some details and characteristics are shown of 400 and 245 kV equipment with which a 0.5% accuracy is attained.

Z.A.A.Krajewski

621.314.223

3993 LARGE AUTOTRANSFORMERS. K.Schlosser.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 2, 59-67 (Jan. 18, 1960). In German.

A general comparison is made between the operational behaviour of autotransformers and ordinary transformers. Power, short-circuit voltage and short-circuit and zero impedance are analytically expressed in their functional relation to transformation ratio. The magnetic field of both the auto- and the ordinary transformer in the case of a short-circuit is investigated. The rating of the tertiary winding is discussed at some detail. Some examples of large auto-transformers recently installed are given with their principal technical characteristic data.

R.Neumann

POWER CONVERSION

621.314.261

3994 A POWER CONVERTER FOR MEDIUM FREQUENCIES WITH CERAMIC PERMANENT MAGNETS. E.Laurila.

Ann. Acad. Sci. Fennicae A VI, No. 40, 6 pp. (1960). In German.

An illustrated description of this converter which consists of a 25 kVA 3 ph. induction motor coupled to 25 kW 16-pole alternator, the rotor of which is formed by permanent magnets of Koerox 300 ceramic material. Each pole element consists of a centre piece $200 \times 60 \times 20$ mm^3 flanked by two pole shoes. The 16 pole-elements are clamped between two end disks. Iron losses are comparatively high as the stator laminations (taken from a standard induction motor) are too thick. These cause a temperature rise of 80°C even at no-load.

R.Neumann

621.314.5 : 621.373.52

PRACTICAL DESIGN PROBLEMS IN TRANSISTOR D.C./D.C. CONVERTORS AND D.C./A.C. INVERTERS. See Abstr. 3548

621.314.63 : 539.2 : 537.311

3995 SURFACE PROBLEMS WITH SEMICONDUCTOR RECTIFIERS. H.H.Plagemann.

Nachrichtentechnik, Vol. 9, No. 7, 292-5 (July, 1959). In German.

A discussion of the effects of the ambient atmosphere on the reverse current of germanium diodes. An increase in humidity leads to an increase in reverse current, and the change is larger in a nitrogen atmosphere than in one of oxygen. It is therefore important to control the atmospheric conditions during transistor production.

C.Hilsum

621.314.63 : 621.382.2 : 621.316.91

3996 THE CHARACTERISTICS AND PROTECTION OF SEMICONDUCTOR RECTIFIERS. D.B.Corbyn and N.L.Potter.

Proc. Instn Elect. Engrs, Paper 3135U, publ. Nov., 1959 (Vol. 107A, 255-69, 269-72, June, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 76 of 1960.

621.314.63

3997 SEMICONDUCTOR RECTIFIERS IN ELECTROLYSIS. W.van Dievoet.

Rev. E, Vol. 3, No. 1, 31-42 (1960). In French.

Explains the advantages of germanium and silicon rectifiers for the heavy-current low-voltage supplies required by electrolytic plant, and outlines their operation in a three-phase bridge circuit. Rectifier losses are described, and the cooling and rating of the units investigated, using an equivalent electrical circuit to represent the path of heat flow. Current-surge protection is described, and the relationship between efficiency and output voltage is given. 12 references.

E.F.Hansford

621.314.634

3998 ANALYSIS OF THE D.C. CHARACTERISTIC OF SELENIUM RECTIFIERS. H.Lauckner.

Z. angew. Phys., Vol. 12, No. 4, 171-7 (April, 1960). In German.

The current—voltage characteristic is split up into a number of sections, which are treated separately. Several side-effects, such as the series resistance of the semiconductor and a parallel leakage resistance are subtracted, and the characteristic remaining is then found to follow the theoretical exponential law, at least with moderate voltages. The slope of the log I versus V curve is, however, less than the theoretical value and this is attributed to the existence of a CdSe layer at the rectifying junction. The origin of the various side-effects is discussed at some length in the light of measurements at temperatures other than ambient.

K.W.Plessner

621.314.65

3999 INVERTERS. F.Höliers.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 5, 91-8 (March 1); No. 6, 123-8 (March 15, 1960). In German.

The inverter operation of a mutator is defined and compared with rectifier operation. The practical significance of the inverter is discussed, in particular, its application in high-power transmission and conversion (h.v. d.c. transmission). But apart from this, the inverter is now frequently applied for field excitation, e.g. in particle accelerators and in Ward-Leonard drives for rolling mills, and the operation of inverters used for such purposes is discussed. Self-controlled inverters, i.e. those which are not connected to an existing a.c. supply system, are also described. The current and voltage conditions of inverters, the process of commutation, the stability and possibility of the occurrence of relaxation oscillations, the extinguishing angle and its calculation, reactive power and measures for improving stability and p.f. are discussed.

R.Neumann

621.314.65

4000 EFFECT OF CATHODE SURFACE ROUGHNESS AND OXIDATION ON ARC MOVEMENT. T.J.Lewis and P.E.Secker.

Nature (London), Vol. 186, 30-1 (April 2, 1960).

The effect of surface roughness and oxidation on the velocity of the arc is investigated for a number of different electrode materials. Marked differences in velocity are found for some time after the initiation of the arc. The effect is attributed to differences in the ease with which new emission sites can be conditioned, and to differences in the rate of decay of emission efficiency of the current site.

E.A.Ash

POWER TRANSMISSION
OVERHEAD LINES . CABLES

621.315.051.024

4001 A PHYSICAL MODEL OF THE D.C. TRANSMISSION SYSTEM FROM THE STALINGRAD HYDROELECTRIC STATION TO THE DONBAS. V.V.Voskresenskii, Kh.F.Barakaev and L.V.Travin

Elektrichestvo, 1960, No. 2, 28-34 (Feb.). In Russian.

This model, which is described, can also be used for other d.c. transmission systems with different rating and of different lengths. Details are given of the modelling methods and of the errors which ensue. Some results of an investigation into the voltage curves and amplitudes in rated conditions are presented.

Associated Electrical Industries (Manchester)

621.315.1 : 621.316.13

4002 DEVELOPMENT OF THE 36 kV AND 150 kV SUPPLY SYSTEMS OF THE BRUSSELS REGION. R.Normand and J.George.

Bull. Soc. Roy. Belge Elect., Vol. 75, No. 4, 273-85 (Oct.-Dec., 1959). In French.

A network analysis was carried out on an I.B.M. machine to determine the transformer rating and grouping on the 36 and 150 kV networks feeding the 6 kV distribution system. The existing radial system is being reinforced by interconnections and a new 150 kV ring running between the Brussels suburbs and adjacent built-up areas. Details of the transmission line are given, including the method used for stringing conductors under tension. P.Linton

621.315.145

4003 ABILITY OF OVERHEAD-LINE CONDUCTORS IN MEDIUM-HIGH-VOLTAGE RURAL NETWORKS TO WITHSTAND SHORT-CIRCUITS. J.Tuercke.

Elektrotech. Z. (E.T.Z.)A, Vol. 81, No. 8, 294-300 (April 11, 1960). In German.

When selecting conductor sections care must be taken that the mechanical strength of the conductor will not be reduced by the thermal effect of short-circuit currents. Simple principles for selection of conductor sizes in medium-high-voltage rural networks are derived from published curves of heating by short-circuit currents and from experimental results on the cooling of conductors. Account is taken of normal reclosure 2 - 3 min. after disconnection of the line and also of auto-reclosure. Curves and tables are given relating conductor section to short-circuit MVA. A.P.Wilmshurst

621.315.17

4004 THE FRENCH 400 kV SYSTEM: STRUCTURE, FUTURE DEVELOPMENT. F.Cahen.

Bull. Soc. Franc. Elect. (Ser. 8), Vol. 1, No. 1, 11-19 (Jan., 1960). In French.

A discussion of the technical and economic considerations underlying the design of the new 400 kV section of the French e.h.v. system and its future extensions with particular reference to its parallel operation with the 225 kV system. The various possible alternative sizes and combinations of the required 225/400 kV transformers are discussed in detail taking into account economics as well as security of operation, and the reasons for deciding on the present standard practice are explained. H.Norel

621.315.17

4005 CORONA AND CONDUCTOR WORK FUNCTION. H.S.Dixon.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1316-19 (1959) = Pwr Apparatus Syst., No. 45 (Dec., 1959).

An analysis is given of the theoretical aspects of an alleged influence of conductor work function on corona in air at atomspheric pressure. Experimental data are presented showing that for higher voltages the conductor work function has a negligible effect on the a.c. corona initiation voltage and the a.c. corona loss. The configuration studied was a 0.125 in. dia. rod concentric with a 6.5 in. dia. surrounding cylinder. E.M.Dembinski

621.315.2 : 621.315.61

4006 GASEOUS DISCHARGE PHENOMENA IN HIGH-VOLTAGE D.C. CABLE DIELECTRICS. E.C.Rogers and D.J.Skipper.

Proc. Instn Elect. Engrs, Paper 3144 S, publ. Jan., 1960 (Vol. 107A, 241-51, 251-4, June, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 91 of 1960.

621.315.2

4007 CABLES WITH SHAPED CONDUCTORS. V.Bardoux.

Rev. Jeumont, Vol. 52, 139-52 (1959). In French.

After examining the interest in, and general characteristics of, cables with shaped conductors, the Jeumont techniques for the manufacture of these cables are described. In particular, the compactness, appearance, bending properties and flexibility as well as the regularity of the construction are studied. W.A.Walker

621.315.2

4008 INVESTIGATION OF THERMAL COEFFICIENTS OF BUNCHED MARINE CABLES. P.P.Denisov.

Zh. tekh. Fiz., Vol. 29, No. 1, 146-50 (Jan., 1959). In Russian. English translation in: Soviet Physics—Technical Physics (New York), Vol. 4, No. 1, 127-30 (Jan., 1959).

In order to solve practical problems in determining the temperature gradients of bunched marine cables, it is necessary to know the numerical values of thermal coefficients of the bunch. A method is advanced here of experimental investigation of thermal coefficients of bunched marine cables based on the theory of steady-state conditions. As a result of experimental investigations of the given method, the values of thermal coefficients a, λ, and c_{sp} for bunched marine cables were determined for the first time, as well as the relation governing their variation with the change of the percent copper content in the bunch.

621.315.211

4009 DIELECTRIC BREAKDOWN BY THERMAL INSTABILITY IN D.C. CABLES. M.Fallou.

Rev. gen. Elect., Vol. 68, No. 12, 693-5 (Dec., 1959). In French.

The conductivity of oil-impregnated paper insulation rises with increase of stress and temperature. The consequent change of stress distribution in paper cables under d.c. load and the possibility of thermal failure are discussed. J.H.Mason

621.315.213

4010 MAGNETIC COUPLING BETWEEN PAIRS IN TWO STAR QUADS. H.Lau.

Arch. Elektrotech. (Berlin), Vol. 44, No. 6, 331-54 (1959). In German.

Refers to the design of telephone cables within minimum magnetic coupling between circuits. A method of computing the coupling is developed and illustrated by a numerical example. V.G.Welsby

621.315.221.5

4011 AMERICAN LEAD ALLOY CABLE SHEATHS. I. CABLE SHEATH REQUIREMENTS. II. ALLOY COMPOSITIONS AND DEVELOPMENT. S.A.Hiscock.

Elect. J. Vol. 164, No. 16, 1102-3, 1103-4 (April 15, 1960).

Part I is a general consideration of the properties required in cable sheaths. Part II summarizes the information available on the compositions, properties and applications of American cable-sheathing alloys, particularly those containing arsenic. These are compared with alloys used in the U.K. A.P.Wilmshurst

INSULATORS
SUPPORTS . CONNECTIONS

(See also Insulating Materials)

621.315.62 : 621.317.333

4012 RESEARCH ON THE PERFORMANCE OF HIGH-VOLTAGE INSULATORS IN POLLUTED ATMOSPHERES. J.S.Forrest, P.J.Lambeth and D.F.Oakeshott.

Proc. Instn Elect. Engrs, Paper 3014 S, publ. Nov., 1959 (Vol. 107A, 172-87, 187-96, April, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 7026 of 1959.

621.314.65 : 621.316.722

4013 LINEAR CIRCUITS REGULATE SOLID-STATE INVERTER. R.Wileman.

Electronics, Vol. 33, No. 16, 61-3 (April 15, 1960).

Describes a 50 watt inverter with a 115 volt 400 c/s output regulated to ± 0.2%, total distortion 1%. This performance is obtained with transistors used in linear circuits. Plug-in tuning forks enable the frequency to be varied between 360 and 440 c/s, with accuracies up to 0.01%. The operation of the inverter is described in detail, and illustrated with circuit diagrams giving component values. E.F.Hansford

621.315.68

4014 SIMPLER LOW-VOLTAGE SERVICE JOINTING TECHNIQUE. H.W.Taylor.

Elect. Times, Vol. 137, 451-3 (March 24, 1960).

The making of small compression-type joints in paper-insulated, lead-covered and armoured-cable conductors is described, together with methods of sealing. Steps in the development of the single-compression ferrule-joint are given. Despite the fact that the method entails cutting three wires of a core and leaving three ends unconnected, tests on three types of joint:- (a) normal soldered joint; (b) bridge-type compression ferrule; and (c) single compression ferrule - with currents of up to 100 A, showed that there was nothing to choose

between any of them from a heating point of view. The use of unarmoured p.v.c. cables with concentric neutrals is discussed. Advantages to be expected by the general introduction of these joints using small compression ferrules are: (1) use of much less material and fewer tools and equipment; (2) cheaper transport due to (1); (3) less working and waiting time; (4) increased safety owing to the absence of risk of burns from hot metal or compounds. H.A.Miller

621.315.682

4015 SOLDERLESS CONNECTIONS. P.R.Rowland.
Elect. Times, Vol. 137, 491-5 (March 31, 1960).

The basic concepts involved when a ferrule is compressed onto a wire to give an electrical connection are reviewed. It is shown that certain popularly held beliefs — particularly concerning the roughness of surfaces and cold welding — are not in accordance with practice or theory. It is considered that the most profitable approach is from fundamental ideas on the structure of metals, their properties and the nature of oxide films on their surfaces.
Central Electricity Generating Board Digest

DISTRIBUTION . INSTALLATIONS

621.316.11 : 681.142

4016 THE LOGICAL DESIGN OF ELECTRICAL NETWORKS USING LINEAR PROGRAMMING METHODS. U.G.W.Knight.
Proc. Instn Elect. Engrs, Paper 3138 S, publ. Dec., 1959 (Vol. 107 A, 306-14, 314-19, June, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 103 of 1960.

621.316.15

4017 NON-SYMMETRICAL LOADING OF MUNICIPAL LOW-VOLTAGE DISTRIBUTION NETWORKS. A.A.Tushina.
Elektrichestvo, 1959, No. 10, 15-21 (Oct.). In Russian.

The use of coefficients representing ratios of symmetrical components of different sequences is propounded for comparing the degree of load non-symmetry. The coefficient of non-symmetry, $k_{n.s}$, for a system with no zero sequence components is defined as the ratio of negative to positive sequence components. Applying probability treatment to a case of a distributor with "n" consumers, $k_{n.s}$ was found to be given with sufficient accuracy by $\frac{1}{\sqrt{n}}$ for $n > 10$. The result was verified experimentally. E.M.Dembinski

621.316.174

4018 THE TREND TO A.C. FOR SHIPS' INSTALLATIONS. H.Unwin.
Elect. Supervisor, Vol. 40, No. 3, 56-61 (March, 1960).

A comparison of d.c. and a.c. ship systems by a proponent of the latter. The lower cable sections and the advantages of squirrel-cage motors are stressed; switchboards and system layouts are discussed. P.Linton

621.316.35

4019 HEATING OF CURRENT-CARRYING PARTS IN ELECTRICAL APPARATUS. A.M.Zaleskii, M.B.Moiseev and E.G.Popova.
Elektrichestvo, 1960, No. 2, 73-7 (Feb.). In Russian.

The production of high-capacity generators (up to 600 MW) means that a current of up to 20 kV can be expected for the associated high-voltage apparatus. Contains the results of an investigation into the problem of temperature-rise of conductors. Tests were carried out at 6.0, 12.0, 12.2, and 12.34 kA on conductors with various cross-sections, and on the moving contacts of disconnecting switch blades. It is shown that a box-like shape is the most favourable with regard to temperature rise.
Associated Electrical Industries (Manchester)

SWITCHGEAR

621.316.5

4020 INVESTIGATION OF ON-LOAD SELECTOR SWITCHES AND TAP-CHANGERS (DR.JANSEN SYSTEM) FOR HIGH SWITCHING FREQUENCY. R.Klaus.
Elektrotech.Z. (E.T.Z.)A, Vol. 81, No. 2, 67-74 (Jan. 18, 1960). In German.

The vector diagram of the transition through the passing resistances is shown to resemble either a notched flag (Fahn) or a triangular flag (Wimpel) hoisted on the main voltage vector as mast. A combination of these two is particularly described, 4 resistances being used instead of 2. The theory and operation are described and test oscillograms are given. Practical experience is discussed and illustrations of contact wear are shown. A bibliography and a discussion are added. R.G.Jakeman

621.316.5

4021 MEASUREMENT OF CONTACT REBOUND IN SWITCH APPARATUS. H.Franken.
Elektrotech. Z. (E.T.Z.)B, Vol. 12, No. 3, 53-4 (Feb. 8, 1960). In German.

Contact rebound, which affects the utility and lifetime of switch apparatus, and which was studied in a previous paper (Abstr. 1547 of 1955) is here investigated in greater detail by improved methods.
P.M.Davidson

621.316.57

4022 STATISTICAL METHOD OF SELECTING THE VOLTAGE IN TESTING THE INTERRUPTING CAPACITY OF CIRCUIT-BREAKERS. V.V.Kaplan, V.M.Nashatyr', and V.L.Ivanov.
Elektrichestvo, 1960, No. 2, 69-73 (Feb.). In Russian.

One of the main methods of testing the interrupting capacity of circuit-breakers is to test the individual elements and to re-calculate the results for the circuit-breaker as a whole. It has been shown that, as a result of the statistical nature of the arc-extinction process, it is possible to re-calculate the interrupting capacity of the individual elements for the circuit-breaker as a whole without regard for the nature of the capacitive distribution of the voltage. Results of tests carried out in 1958-9 to check this theory are given.
Associated Electrical Industries (Manchester)

621.316.57.064.24

4023 AIR-BLAST CIRCUIT-BREAKERS. F.O.Mason.
Elect. Rev., Vol. 166, No. 13, 571-2 (March 25, 1960).

Research concerning the recording of the residual currents around the current zero period during arc interruption in air-blast circuit-breakers is described. Sources of error encountered in recording are considered.
Central Electricity Generating Board Digest

621.316.57.064.25

4024 CONTRIBUTION TO DYNAMIC BEHAVIOUR OF THE ARC IN THE LOW OIL-CONTENT HIGH-VOLTAGE CIRCUIT-BREAKERS. H.Kopplin and E.Schmidt.
Elektrotech. Z. (E.T.Z.)A, Vol. 80, No. 23, 805-11 (Dec. 1, 1959). In German.

Experiments were carried out on a 110 kV expansion circuit-breaker to investigate zero-current phenomena. Special highly sensitive equipment was used to measure post-arc current. Analysis of the voltage and current flow following zero-current transition shows that the thermal arc time-constant for small currents is 10 μs and for current > 4 kA less than 5 μs. Because of the low time-constant and quickly increasing extinguishing intensity, no post-arc current was observed, in spite of high sensitivity of the measuring circuit. The high extinguishing intensity showed itself also in accelerated interruption of breaker current some 10 μs before na natural zero. This indicated a premature arc extinction and also that at the instant of natural zero there is no residual conductivity in the arc. From the results obtained the critical rate-of-rise of recovery voltage for thermal restriking can be established. This value lies between 2 and 4 kV/μs and corresponding frequency of recovery voltage between 5 and 10 kc/s with an overshoot factor of 1.5.
W.J Grek

REGULATION

621.316.717

4025 CALCULATION OF STARTING RHEOSTATS. A.Picardat de Puthaux.

Electricien, Vol. 88, 23-8 (Feb.); 50-7 (March); 71-6 (April, 1960). In French.

The investigations refer to metallic starting rheostats and give simple rules for determining the number of contacts and resistors forming the various sections of the rheostat. The first part of the article deals with starters for d.c. shunt motors, and it is shown that the total resistance and the resistances of successive sections form decreasing geometric series with a ratio given by the ratio between min. and max. current. The number of sections of the rheostat and the ratio between min. and max. current are not independent from each other and only one of these parameters can be chosen freely. A numerical example for calculation of a rheostat is given and the speeds corresponding to the various positions of the operating lever are calculated. Finally a simple graphical method for the determination of the resistances is described. In the second part, similar investigations are carried out for the starter of a d.c. series motor. The case is somewhat more complicated since the variation of the flux must be taken into consideration. The third part covers the calculation of starting resistances for asynchronous motors. R.Neumann

621.316.718 : 621.34

DEVELOPMENTS IN ELECTRICAL EQUIPMENT FOR REVERSING PLATE MILLS. See Abstr. 3388.

621.316.718.5 : 621.313.333

4026 THE KRÄMER CASCADE WITH METALLIC RECTIFIERS. J.Ben Uri, Y.Wallach and E.Eliath.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 3, 52-6 (Feb 1, 1960). In German.

In the Krämer cascade for the speed regulation of induction motors, the motor-generator is replaced by a metallic rectifier. The theory is examined and test results on a 7½ h.p. motor are summarized. It is concluded that the scheme is very promising even up to 500 kW. For a speed regulation of 30–40%, it is 40% cheaper than a Ward-Leonard drive. A bibliography is added. R.G.Jakeman

621.316.718.5 : 621.313.333

BRUSHLESS VARIABLE-SPEED INDUCTION MOTORS USING PHASE-SHIFT CONTROL. See Abstr. 3974

621.316.719

4027 ELECTRIC BRAKING OF AC AND DC MOTORS. J.A.Zielinski.

Rev. gen. Elect., Vol. 69, No. 1, 19-35 (Jan., 1960). In French.

Distinguishes between (1) reverse current braking; (2) rheostatic braking; and (3) regenerative braking. The advantages and disadvantages of each method for both a.c. and d.c. machines are discussed. A detailed mathematical analysis, with circle diagrams, is made of the conditions under which the machines are operating when used for braking purposes. Complex conditions can arise in a.c. machines with rotating fields, where it is possible to impose a d.c. current or, alternatively an a.c. current of lower frequency, on the a.c. winding for retarding purposes. Concludes with a table summarizing the methods of electrical braking appropiate to different types of machine. D.R.Way

621.316.722

4028 LINE VOLTAGE CONTROL USES ZENER DIODES. R.A.Greiner.

Electronics, Vol. 33, No. 6, 64 (Feb. 5, 1960).

This stabilizer circuit provides a 2 A load without appreciable distortion at 110 V ±0.5 V from a supply voltage ranging from 140-113 V. A rectified and smoothed voltage derived from the stabilized output is compared against a Zener-diode reference source in a comparison amplifier. The output from this amplifier is amplified and applied to the control transistors in series with the supply line so regulating their emitter–collector impedance and hence the voltage drop in the line. H.G.M.Spratt

621.316.722 : 621.314.65

LINEAR CIRCUITS REGULATE SOLID-STATE INVERTER. See Abstr. 4013

621.316.722 : 621.387

IMPEDANCE/FREQUENCY CHARACTERISTICS OF GLOW-DISCHARGE REFERENCE TUBES. See Abstr. 3705

621.316.722/.726 : 621.316.13

4029 REQUIREMENTS OF NETWORKS AS REGARDS REGULATION OF VOLTAGE AND REACTIVE POWER. M.Erich.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 5, 176-81 (Feb. 29, 1960). In German.

The importance of maintaining substantially constant voltage in different kinds of network is discussed and the means available are considered. For a power system as a whole the problem is largely that of controlling reactive power by the excitation of plant and the use of capacitors and shunt reactors. The voltage of sections of networks is regulated by tap-changing transformers. On l.v. networks the problem is more economic than technical. A.P.Wilmshurst

621.316.728 : 621.313.33

4030 THE FREQUENCY CASCADE WITH METALLIC RECTIFIERS. J.Ben Uri.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 6, 117-20 (March 15, 1960). In German.

An examination of the Scherbius cascade for the speed regulation of induction motors, in which a metallic rectifier is used. The addition of a frequency-changer makes it possible to operate above synchronism. Characteristic curves are developed. The starting and operation are discussed. A bibliography is added. R.G.Jakeman

621.316.728 : 621.314.2

4031 AUTOMATIC SWITCHING OF TRANSFORMERS ON VARIATIONS OF LOAD. K.Hamerak, Jr.

Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 24, 860-2 (Dec. 11, 1959). In German.

Factories are generally supplied through several transformers of equal rating which are switched manually depending on the load. Expressions are derived for minimum losses with different numbers of transformers and an equipment is described whereby transformers are switched automatically according to the readings of a kVA meter. A.P.Wilmshurst

621.316.728

4032 THE REGULATION OF LARGE WATER-TURBINE ALTERNATORS. H.Achenbach.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 7, 227-40 (March 28, 1960). In German.

Deals in detail with voltage regulation on sets above 10 MVA. After explaining why the problem is more complex than with steam sets the author shows statistical data on the main characteristics such as excitation power, time constants, and reactances based on a large number of actual machines. Modern regulating circuits are discussed, including transistors, transductors and magnetic amplifiers, and there is a detailed analysis of transient behaviour. P.Linton

621.316.729

4033 AUTOMATIC SYNCHRONISING. G.F.Travis.

Elect. Rev., Vol. 166, No. 18, 816-21 (April 29, 1960).

In order successfully to parallel an alternator to an energized system the frequency should not differ by more than 0.25% and the phase difference between the voltages should be less than 10 or 15°, at the same time the running and incoming voltages should be approximately equal. A description is given of a speed matching relay consisting of two single-phase synchronous motors arranged differentially to control the governor of the prime mover; a balanced-beam voltage-matching relay controls the incoming alternator excitation. These two devices function in conjunction with a three-element phase-sensitive relay which, when all conditions have been established, operates the master contactor to close the circuit-breaker. Detailed schematic diagrams are shown for single machines and for multi-unit arrangements. M.Rathbone

PROTECTION

621.316.91 : 621.316.722.1

4034 A CIRCUIT FOR THE PROTECTION OF A STABILIZED TRANSISTOR POWER SUPPLY.

H.Kemhadjian and A.F.Newell.

Electronic Engng, Vol. 32, 228-30 (April, 1960).

The overload protection circuit described can switch off the supplies in less than 50 μsec. The current at which the protection circuit operates can be set to much lower currents than the full available output of the power supply. Thus experimental circuits, powered by the stabilized supply, will also be protected against any damage arising from faults within those circuits.

621.316.925 : 621.313.333

4035 C.M.R. INDUCTION MOTORS AND OVERLOAD PROTECTION. R.A.F.Craven.

Elect. Times, Vol. 137, 369-73 (March 10, 1960).

To reduce the incidence of motor burn-out it is necessary to investigate the accuracy and reliability of methods of overload protection. This present study deals with the case of the inverse-time solenoid dashpot relay as a mode of protecting motors from overheating rather than the thermal relay. The design criteria for such a relay are considered on a basis of time-current characteristics, time-delay, cyclic loading, and "single phasing".

G.V.Hargreaves

621.316.925 : 621.311.161

4036 PROTECTION OF THE NETHERLANDS INTER-CONNECTED SYSTEM. A.P.Lindenbergh.

Electrotechniek, Vol. 38, No. 2, 75-85 (Jan. 21, 1960). In Dutch.

The Dutch interconnected system consists of a 110 kV network in the NE. and a 150 kV network in the W. and S. of the country. Both are linked by a 150 kV line between Nijmegen and Deventer, with 150/110 kV transformers at the latter place. All large stations in the Netherlands are connected to this grid and thereby coupled in parallel. The main systems of line protection: distance, directional comparison, differential and phase comparison protection are compared. The extent to which these systems provide reserve protection and protection of the busbars is considered and ten reasons are given for the choice of Brown Boveri distance-relay protection on the Netherlands system. The operation, modifications to standard equipment required, adjustment, and experience of 5 years' service of these relays is discussed.

G.N.J.Beck

621.316.925 : 621.313.12

4037 RECENT DEVELOPMENTS IN THE FIELD OF GENERATOR PROTECTION. L.Ferschl.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 1, 3-11 (Jan. 1, 1960). In German.

An illustrated general survey of the development of generator protection systems. The tasks of the protective systems are outlined and the various cases of faults are described. One of the principal means for protection is the moving-coil relay previously described (Abstr. 2336 of 1955). Comparative illustrations show the effects of faults on protected and non-protected generators. Particular attention is paid to a system of differential protection for transformers which prevents the operation of the system if the transformer is switched on no-load. This is accomplished either by the combination of delayed fine protection with non-delayed coarse protection or by a current-dependent delayed differential protection. The use of nonlinear stabilization is explained.

R.Neumann

621.316.925 : 621.313.12

4038 RECENT DEVELOPMENTS IN THE FIELD OF GENERATOR PROTECTION, PART II. L.Ferschl.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 3, 56-62 (Feb. 1, 1960). In German.

For previous part see Abstr. 4037 of 1960. The second part describes and illustrates protection equipment for the following faults: earth shorts of carcase, interturn short-circuits, rotor earthing shorts, asymmetry by the breaking of a phase conductor, excess voltage caused by overspeed of hydroelectric generator, reverse power caused by blade damage or by the operation of the high-speed closing valve of the turbine. Methods for the rapid de-energizing of generators are briefly described and testing equipment for protective gear is discussed.

R.Neumann

621.316.925

4039 A NOVEL EARTH FAULT SELECTOR FOR DETECTING EARTH FAULTS IN LINE AND CABLE SECTIONS.

W.Dotzenrath.

Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 1, 1-4 (Jan. 11, 1960). In German.

Measurement of the potential between the system neutral and earth serves to detect earth faults but cannot locate them when the system consists of a number of feeders and branch lines. A device has been developed to localize earth faults by comparing the phase angle of the earth fault current with that of the supply voltage. A voltage proportional to the earth fault current is amplified and forms one input to a modulator circuit, the other input being proportional to the supply voltage. A phase-shifting device is inserted in the amplifier circuit and is set so that the d.c. component of the modulator output detected by a moving-coil instrument is a maximum. Reversal of the earth fault current direction results in a reversed instrument reading so that sound and faulty feeders can be differentiated. The equipment has been further developed for automatic operation for use where a large number of feeders is involved, the moving-coil instrument being replaced by a polarized relay.

A.S.Hay

621.316.925 : 621.317.39

ZERO-SPEED MONITORS AND THEIR APPLICATION IN SEQUENCE CIRCUIT ARRANGEMENTS. See Abstr. 3421

621.316.925.2

4040 BUS PROTECTION FOR 110-kV SYSTEMS. G.Abel.

Siemens - Z., Vol. 34, No. 5, 310-15 (May, 1960). In German.

The problem of running 110-kV cables into the centres of large cities produces cable layouts consisting of short sections and multi-bus systems for which high-speed selective protection is required. The newly developed high-speed differential bus protection operates on the principle of current balance in all the cables. The new arrangement in which the differential and stabilizing circuits are combined to form special systems provides a perfectly reliable high-speed protection for multi-bus systems.

621.316.932

4041 AUTOMATIC RECLOSING AS PREREQUISITE FOR SOLIDLY EARTHED NETWORKS. F.Schultheiss.

Elektrie, Vol. 13, No. 10, 389-93 (Oct., 1959). In German.

In unearthed networks, transient earth faults were cleared originally by earthing the phase conductor through an oil circuit-breaker for a short time and later by the use of arc-suppression coils. At first, expulsion protective-gaps and now rapid reclosing perform this duty in solidly earthed networks. With compensated networks, the earth fault-current is limited whereas, when solid earthing and rapid reclosing are used, the equipment is subject to dynamic and thermal stresses caused by the full earth fault current. Slow reclosing may be applied when the equipment in question is supplied from a number of lines but rapid reclosing can be applied more generally. Single-pole reclosing has the advantage that stability is more easily maintained but its application is limited. Pole-sequential reclosing is characterized by the same advantage and disadvantage. Various circuits incorporating auxiliary bus bars for clearing transient faults are described and illustrated.

A.S.Hay

621.316.933

4042 PROBLEMS CONNECTED WITH THE DETERMINATION OF THE WAVE FRONT RESPONSE OF SURGE ARRESTERS [DIVERTERS]. R.Galli.

Bull. Oerlikon, No. 332, 2-7 (Feb., 1960).

Considers the measurement of the front-of-wave impulse sparkover voltage of surge diverters. Errors due to the inductance of the connecting leads to the test object are analysed with reference to a test circuit employing a resistance potential divider. Some results on the effects of the surge generator load capacitance on the front-of-wave sparkover are given. A brief survey is made of the methods of determining transient response of potential dividers and of the use of the measuring cable between the p.d. low-voltage arm and the oscillograph.

E.M.Dembinski

621.316.98

4043 LIGHTNING RISK AND LIGHTNING DAMAGE IN AUSTRIA. V.Fritsch.

Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 4, 78-82 (Feb. 15, 1960).

On the basis of returns collected by Austrian insurance companies statistical results are presented of the financial losses and of the number of cases of damage to buildings and homesteads. It is shown that the lightning risk is highest in agricultural regions. Subdivided figures are given for the lightning damage involving fire and purely mechanical damage and these data are further subdivided for the different regions of Austria. With reference to an earlier publication (Abstr. 4499 of 1957) the question of a correlation between lightning risk and geological conditions is briefly discussed.

R.H.Golde

621.316.98

4044 CONTRIBUTION TO THE QUESTION OF LOCAL LIGHTNING RISK IN OPEN-WIRE TRANSMISSION SYSTEMS WITH REFERENCE TO THE CONSTITUTION OF THE SUBSOIL. G.Lehmann.

Elektrie, Vol. 13, No. 10, 394-400 (Oct., 1959). In German.

The local distributions of lightning faults are plotted which occurred in periods up to 30 years on short lengths of 110 kV and 30 kV lines. Similar distributions for shorter periods are given for points of strokes to lines. The effect of the geological formation of the subsoil is examined and this is compared with laboratory investigations.

R.H.Golde

621.316.99

4045 DEEP EARTHING. W.A.Wales.

Elect. Times, Vol. 137, 476-7 (March 24, 1960).

An analysis of test results using six steel rods with welded exteriors of heavy-gauge copper in made-up and porous subsoils. The standard length of rod used was 7 ft and the diameter $\frac{5}{8}$ in. Depths reached by the use of the rig and hammer varied with the soil conditions for the specified resistance value not exceeding 2 Ω. A graph shows resistance plotted against depth at three sites in the London area. In two cases six rods were needed to reach the required resistance value; in the third case it was achieved with the driving of the fifth rod. Actual values of resistance at the end of driving each rod are given in a table. Resistance is inversely proportional to the buried length of rod. Near the surface the soil resistivity is usually high and variable, whereas at greater depths resistivity decreases and becomes more consistent excepting where the subsoil consists of several thin strata of varying geological nature or contains a large number of rock inclusions or cavities.

H.A.Miller

621.316.99

4046 EARTHING PROBLEMS. W.Koch.

Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 7, 154-8 (April 4, 1960). In German.

It is necessary to determine the conductivity of the earth when planning an earthing installation. Not only the conductivity at the surface, but also that at depth must be measured. A device has been developed for measuring the effective earth conductivity using relatively short probes. Earthing rods up to 20 m long are used for small and medium-sized plants, whilst surface earths are more convenient for large installations. The use of earthing rods depends upon the ground conditions and various equipments have been developed for driving in the rods. The protection afforded by earthing can be enhanced through potential control especially where the neutral point is earthed directly or difficult earthing conditions prevail.

A.S.Hay

621.316.99 : 621.317.329

APPLICATION OF THE ELECTROLYTIC TANK TO EARTHING AND OTHER SYSTEM DESIGN PROBLEMS. See Abstr. 3397

TRACTION . DRIVES

621.332.3

4047 RAILWAY OVERHEAD SYSTEMS. THE DESIGN AND ERECTION OF 25 kV EQUIPMENT. G.W.Launder.

Elect. Rev., Vol. 166, No. 18, 807-10 (April 29, 1960).

621.335.22 : 621.314.63

4048 50 c/s ELECTRIC LOCOMOTIVES WITH SILICON RECTIFIERS. P.Lamberts.

Rev. E., Vol. 3, No. 1, 44-52 (1960). In French.

Traces the development of electric drives for locomotives up to the rectifier type, which combines the advantages of high-voltage single-phase transmission at standard frequency with the superior performance of d.c. motors for traction. Explains how the speed/tractive-effort characteristics of rectifier drives enable heavy trains to start up without risk of wheel slip. The ripple from the single-phase push-pull or bridge rectifier circuit is smoothed with a choke to 20-30%. The advantages of using silicon rectifiers are stated, and protection of the latter against short circuits is described with diagrams illustrating the preference for the bridge circuit. Three other applications for rectifiers on locomotives are outlined.

E.F.Hansford

621.335.3 : 621.396.65

4049 DISTURBANCE OF RADIO TELEPHONE ON COLLIERY LOCOMOTIVES AND PROTECTIVE MEASURES. O.Görk.

Elektrotech. Z. (E.T.Z) B, Vol. 12, No. 1, 5-6 (Jan. 11, 1960). In German.

Telephone communications to and between locomotives uses the contact wire as a guide. Disturbance by parasitic radiation is overcome by sufficiently high level. Additional loads (as lamps) supplied from the contact wire as well as the supply rectifiers, particularly bridge-connected semiconductor-rectifiers, are, for the radio frequency, leakages or even short circuits to earth. The remedy is to insert chokes or, at rectifiers, tuned circuits without iron. Transmission is reliable over about 1 m.

H.R.J.Klewe

621.34

4050 TRANSISTOR AMPLISTAT-REGULATED SECTIONAL DRIVE AT SOUTHLAND PAPER MILLS. A.E.Vickery and G.E.Shaad.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 369-75 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

Reviews briefly the progress in paper-mill electrical equipment and suggests that this drive is more economic and will require even less maintenance than electronic-amplidyne multiple-generator drives. Gives a detailed description with photographs, block diagrams and performance data.

J.T.Hayden

CONDUCTORS . RESISTORS

(See also Semiconductor Materials)

621.315.5.014.12

4051 TOTAL SKIN EFFECT AT CURVED CONDUCTOR SURFACES. K.Schönbacher.

Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 23, 823-6 (Dec. 1, 1959). In German.

The skin-effect is investigated for arbitrarily curved conductor surfaces under the simplifying assumption that the depth of penetration is very small in comparison with the radii of curvature. The skin resistance is calculated for the case of a conductor traversed by a current and of one traversed by a magnetic flux causing the flow of eddy currents. In either case the characteristic impedance is modified by an additional ohmic term which is positive in the first case and negative in the second. It is shown that a full cylinder traversed by an axial field and a hollow cylinder traversed by an axial current are equivalent. Skin resistance at various points of a current-traversed toroidal conductor are tabulated. Finally the skin-effect is treated as a problem of potential theory and some phenomena occurring in the induction heating of ferromagnetic work pieces are explained.

R.Neumann

621.315.56

4052 NOISE FROM CARBON-FILM RESISTORS. K.Biebach.

Nachrichtentechnik, Vol. 9, No. 7, 310-13 (July, 1959). In German.

Obtains an expression for the "eigen noise" as per D.I.N. 41400, containing the specific noise capacity C as a factor. Experimental figures are quoted for C for different types of resistor, then the effect of the resistance dimensions is discussed, with experimental graphs for 0.5 and 0.25 W resistors. Considerable care is needed to achieve the D.I.N. 41400 figures for resistors greater than 10^8 Ω.

D.E.Brown

INSULATING MATERIALS
DIELECTRICS

621.315.61 : 539.52

4053 MODERN IDEAS ON THE BREAKDOWN OF DIELECTRICS. G.I.Skanavi.
Elektrichestvo, 1960, No. 2, 1-8 (Feb.). In Russian.

Examines physical processes involved in the breakdown of dielectric materials, and points out that these processes are closely bound up with structure, forces of interaction between particles, and conditions of the movement of charged particles in one or another medium. The breakdown of gaseous, liquid, and solid dielectrics is discussed with reference to various modern theories and experimental results. Associated Electrical Industries (Manchester)

621.315.61

4054 FREQUENCY DEPENDENCE OF THE DIELECTRIC CONSTANT OF SOLID DIELECTRICS. R.Vasyluk.
Slaboproudy Obzor, Vol. 21, No. 3, 145-52 (1960). In Czech.

The concept of a complex (relative) permittivity, $\epsilon = \epsilon' - j\epsilon''$, is introduced and the causes of its frequency dependence are explained. The Debye formula for ϵ is derived. It is pointed out, however, that this expression is not very accurate and that better agreement with the available experimented data is obtained by using the empirical formulae of K.S. and R.H.Cole (1941). The Cole–Cole plots of ϵ'' against ϵ' are introduced. Such graphs, taken experimentally, are given for 25 different dielectrics (ranging from steatite and porcelain to synthetic resins and rubber). R.S.Sidorowicz

621.315.61 : 621.317.333

4055 FUNCTIONAL LIFE TESTS OF APPARATUS AS COMPARED WITH INSULATION MATERIAL TESTS.
M.L.Manning.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 1107-11 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

Most troubles in electrical equipment are due to limitations in the insulation, hence industry, through the A.I.E.E., has developed a new concept of functional testing to bridge the gap between conventional insulation tests and the swift progress of new research, development and applications. Insulation should be classified as systems as well as materials, the manner in which they are applied and processed being as important as the basic materials used. The implications of this idea are considered, with reference to A.I.E.E. publications on test procedures issued over the past 5 years. The paper outlines the organizational procedure followed by reliable companies in making insulation studies, the important properties of insulation in making an analysis, and steps involved in classifying insulating materials or systems by tests. It states the objectives of functional testing, what the A.I.E.E. is doing, and the effect on insulation standards and the cost of apparatus. It considers the possibilities for better insulating materials and systems. E.F.Hansford

621.315.612

4056 HIGH DIELECTRIC CONSTANT CERAMICS. F.Brown.
I.R.E. Trans Compon. Parts, Vol. CP-6, No. 4, 238-51 (Dec., 1959).

Summarizes the principal electrical characteristics, favourable or otherwise, of these materials and attempts to relate them to well-known basic dielectric properties. A brief review of present knowledge of ferroelectricity in $BaTiO_3$ is given, since many of the practical problems encountered in the use of high dielectric-constant ceramics are rooted in the inherent ferroelectricity of the material. A few remarks are included concerning avenues of future advance in high-K ceramic applications.

621.315.615.9

4057 THE BEHAVIOUR OF INSULATING LIQUIDS UNDER GLOW DISCHARGES. F.Held and H.Büchler.
Schweiz. Arch. angew. Wiss. Tech., Vol. 26, No. 1, 13-17 (Jan., 1960). In German.

Tests on aliphatic and aromatic hydrocarbon liquids exposed to discharges show that a "positive gassing factor" is associated with the presence of a definite quantity of aromatic hydrocarbons. The stabilizing action of aromatics is most effective when their vapour pressure is greater than that of other hydrocarbons in the insulating oil. J.H.Mason

621.315.616.96 : 621.316.5

4058 THE APPLICATION OF LOW-PRESSURE RESINS TO SOME HIGH-VOLTAGE SWITCHGEAR DESIGNS.
T.R.Mauley, K.Rothwell and W.Gray.
Proc. Instn Elect. Engrs, Paper 2835 S, publ. Feb., 1959 (Vol. 107A, 213-22, 223-9, April, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 1385 of 1959.

621.315.619.3 : 621.319.4

4059 DIELECTRIC LOSSES DUE TO IONIC CONDUCTION IN [IMPREGNATED] LAYER DIELECTRICS.
W.Held and K.Wenzel.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 4, 121-7 (Feb. 15, 1960). In German.

This is an extension of Garton's work (Abstr. 502 of 1941) which dealt with the field dependence of the power factor of a liquid dielectric in the case when the electrode separation was comparable with the distance travelled by the ions in half a cycle. The present work treats impregnated paper dielectrics where the extent of ionic motion is confined to the narrow gaps between the layers of paper. The power factor is calculated in terms of impregnant viscosity, ion concentration and ionic radius, assuming Stokes' law. Measurements on a chlorinated diphenyl impregnated capacitor are used to check the theory and to derive the ionic radius and concentration. The observed time dependence of the power factor at high fields is considered due to the absorption of ions by the paper. K.W.Plessner

MEASURING METHODS
ELECTRICAL TESTING

621.317.33 : 621.315.2

4060 TESTING OF CABLE INSULATION UNDER LOAD. G.M.Shalyt.
Energetik (Moscow), 1959, No. 5, 8-11. In Russian.

Until recent times the prophylactic testing to cables was done by switching on and off, and testing insulation with 5 or 6 times nominal voltage. This method was laborious and inconvenient; moreover to be effective it had to be carried out at frequent intervals. Statistics show that to reduce the number of breakdowns by 3 times in any given period the frequency of tests must be increased 6 times. In order to test more frequently and with the minimum disturbance to the system the method of testing under load was introduced. This consists essentially of injecting a rectified high voltage into the line or section of line, the magnitude of the voltage being determined by the line voltage and system constants. This method tests for the danger of breakdown to earth which is shown to be the major cause of cable disruption. A schematic diagram of a tested network and the operational results are described. The method has minimized the number of operational breakdowns together with a reduction in the labour involved.
J.S.Wilson

621.317.333

4061 THE USE OF D.C. OVERPOTENTIAL TESTING AS A MAINTENANCE TOOL IN THE INDUSTRIAL PLANT.
W.A.Weddendorf.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 729-36 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

After a brief discussion of the ideal requirements of a non-destructive insulation test method for use in preventive maintenance, d.c. overpotential testing is suggested as a possible solution. To illustrate the effectiveness of the method, tests on cables, machines and transformers are described with the help of leakage current/time and leakage current/voltage curves. Site experience is described and case histories are presented to show how these tests were evaluated. It is claimed that the tests are searching and that they do not damage sound insulation. A short bibliography is included.
H.Sterling

621.317.333 : 621.315.61

FUNCTIONAL LIFE TESTS OF APPARATUS AS COMPARED WITH INSULATION MATERIAL TESTS. See Abstr. 4055

621.317.335

4062 A GRAPHICAL METHOD FOR MEASURING DIELECTRIC CONSTANTS AT MICROWAVE FREQUENCIES.

C.B.Sharpe.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 155-9 (March, 1960).

Describes a graphical method for measuring the real and imaginary parts of the dielectric constant of materials at microwave frequencies. The method is based on the network approach to dielectric measurements proposed by Oliner and Altschuler (Abstr. 1912 of 1955) in which the dielectric sample fills a section of transmission line or waveguide. In contrast to their method, the network representing the dielectric sample is analyzed in terms of a bilinear transformation. The analysis proceeds from the geometric properties of the image circle in the Γ plane obtained by terminating the output line in a calibrated sliding short. The technique described retains the desirable features of the network approach but avoids the necessity of measuring both scattering coefficients. As a result the procedure is more direct and, in the case of the TEM configuration, leads to an entirely graphical solution in which the complex dielectric constant can be read from a Smith chart overlay.

621.317.34

4063 CALIBRATING BROADCAST (f.m.) MODULATION METERS. D.S.Henry.

Electronics, Vol. 33, No. 16, 67 (April 15, 1960).

A Q-multiplier circuit, i.e. a tuned circuit with controlled positive-feedback to raise the Q-factor, is connected across the i.f. circuit of the meter being checked. An indicating c.r.o. is connected to the Q-multiplier and the coil is tuned and adjusted for maximum signal amplitude on the c.r.o. with the transmitter switched on but unmodulated. A.F. modulation of a convenient frequency is now applied and the modulation level steadily raised. A table gives the percentage-modulation values corresponding to each null point of the carrier so enabling the meter calibration to be checked. H.G.M.Spratt

621.317.34 : 621.372.6

4064 ANALYSIS OF MICROWAVE MEASUREMENT TECHNIQUES BY MEANS OF SIGNAL FLOW GRAPHS.

J.K.Hunton.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 206-12 (March, 1960).

Microwave measurement techniques can be analysed more simply by using signal flow graphs instead of the customary scattering matrices to describe the microwave networks used in the measuring system. This is because the flow graphs of individual networks are simply joined together when the networks are cascaded and the solution for the system can be written down by inspection of the overall flow graph by application of the nontouching loop rule. Reviews the method of setting up flow graphs of microwave networks and the rule for their solution. A single directional-coupler reflectometer system for measuring the reflection coefficient of a load is then analysed by this method. The analysis shows how auxiliary tuners can be used to cancel residual error terms in the measurement of the magnitude of the reflection coefficient at a particular frequency. The analysis also shows how an additional tuner can be used to measure the phase angle of the reflection coefficient. These reflectometer techniques are particularly useful in the measurement of very small reflections.

621.317.34 : 621.375.9 : 538.56

4065 NOISE TEMPERATURE MEASUREMENT ON A TRAVELING-WAVE MASER PREAMPLIFIER.

R.W.DeGrasse and H.E.D.Scovil.

J. appl. Phys., Vol. 31, No. 2, 443-4 (Feb., 1960).

A liquid nitrogen input load and one at room temperature could alternatively be connected to a T.W.M., by means of a wave-guide switch. The output was connected through an attenuator to a T.W.-tube amplifier. Adjusting the attenuator so that the same power output was read in the two cases, the amplifier noise was eliminated. A noise temperature of $10.7 \pm 2.26^{\circ}$K was measured. Noise from the input cable contributed $9 \pm 1^{\circ}$K. A second experiment is planned which will eliminate cable loss. H.Motz

621.317.34 : 621.385.1

4066 A METHOD OF MEASURING THE ELECTRONIC ADMITTANCES OF PLANE-ELECTRODE VALVES.

A.I.Kostienko.

Radiotekhnika i Elektronika, Vol. 4, No. 2, 313-20 (Feb., 1959). In Russian.

Describes a method of measuring the electronic admittance of plane-electrode microwave valves by measuring the input admittance using a slotted line. [English summary: PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.317.39

4067 SURFACE-TEMPERATURE MEASUREMENT OF CURRENT-CARRYING OBJECTS. R.Dutton and E.C.Lee.

I.S.A. J., Vol. 6, No. 12, 49-51 (Dec., 1959).

Possible methods are examined and that found most suitable involves a 3-wire thermocouple for tubes, etc., carrying d.c. heating current. The 'couple' comprizes two similar wires, e.g. chromel, welded to a third wire such as alumel between them. The junctions are welded to the current-carrying tube with the junctions axial. The two outer wires are connected to a small potential divider with the tapping taken to one side of the galvanometer, the other terminal of which is connected to the centre wire. The tapping is adjusted by trial until no difference in reading occurs for either direction of heating current, and in this state the method applies also to a.c. heating current. An example of its application to a 15-way measurement is given, using a strip-chart recorder. E.H.W.Banner

621.317.39

4068 VECTOR PRINCIPLES OF INERTIAL NAVIGATION. A.M.Schneider.

I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 3, 159-78 (Sept., 1959).

A vector equation, which is derived from first principles, describes the mechanization of inertial navigation systems for use anywhere in space. A specialized form of this equation applies directly to three-dimensional motion at any speed, any altitude, over an elliptical, rotating earth. The usefulness of this equation is illustrated by working out an example of a system design. Behaviour of errors in inertial systems is also discussed.

621.317.39

4069 LINEAR TACHOMETRY FOR MACHINE TOOLS. M.J.C.Fowell and A.Cowley.

Control, Vol. 3, No. 19, 80-3 (Jan., 1960).

Brief review of some possible methods of obtaining velocity feedback signals from the slides of machine tools: the methods, with their respective limitations and advantages, are tabulated. A.O.Stanesby

621.317.39

4070 PORTABLE DEPTH FINDER FOR SMALL BOATS. H.C.Single.

Electronics, Vol. 33, No. 6, 50-1 (Feb. 5, 1960).

This is a 5-transistor instrument with a single-disk barium-titanate transducer for transmitting and receiving and a neon lamp rotating at the end of a motor-driven arm to act as an indicator. A magnet, also fixed to the rotating arm, passes close to a pick-up coil at one point during its rotation and triggers an otherwise quiescent oscillator circuit to drive the transducer. The resulting 200 kc/s pulse trains have a p.r.f. of 1200 c/s and a duration of 300-500 μsec. Received echo pulses are amplified in two r.f. stages, rectified and again amplified to fire the neon tube. The operating depth range is 120 ft. H.G.M.Spratt

621.317.39

4071 SOME NEW POSSIBILITIES IN CIVIL UNDERWATER ECHO-RANGING. D.G.Tucker.

J. Brit. Instn Radio Engrs, Vol. 20, No. 4, 299-311 (April, 1960).

Describes eight projects currently in hand in the Electrical Engineering Department of the University of Birmingham; these are essentially practical projects, leading more or less directly to substantial improvements in echo-ranging techniques for fisheries operations and research, navigation, surveying and general oceanographical work. The projects are: electronic sector scanning, multiplicative reception, wideband echo-ranging, interferometric echo-sounder, "bottom-lock" frequency-modulated echo-sounder, continuous-wave echo systems, transfer of oscilloscope display to paper chart, and automatic electronic beam stabilization.

621.317.39

4072 MEASURING STRIP STEEL WITHOUT CONTACT. W.C.George.

I.S.A. J., Vol. 7, No. 1, 80-3 (Jan., 1960).

The length of the moving strip is measured by providing a

magnetic recording and a playback head exactly 1 ft. apart along the path of travel. The first head records a pulse in the moving strip which is picked up by the playback head. The output pulse from this head not only operates a counter but also initiates a second recording pulse. The process continues as long as the strip continues to move and the total count is a measure of the footage. The apparatus operates over a speed range of 150-2000 ft/min. Three sources of error are: (1) circuit time delay; (2) signal clipping due to signal amplitude changes at different speeds; and (3) random noise. Compensation for (1) and (2) is effected by a time-sensing technique which introduces an additional variable time delay so that the sum of all the delay components is constant regardless of strip speed. H.G.M.Spratt

621.317.39 : 539.1.07

4073 FAST COINCIDENCE CIRCUIT WITH TIME ANALYSER. E.Rémy and K.Winter.

J. Phys. Radium, Vol. 18, Suppl. No. 7, 112A-115A (July, 1957). In French.

Precision in the measurement of neutron energies, by the time of traverse method, depends on the quality of coincidence circuits employed. Speed-up of measurements has been achieved recently by chronometric circuits which give rapid readings of different traverse times i.e. of the whole energy spectrum. A system is described with a resolution potential of 0.3 mμsec, a linear time scale in the range of 2 to 16 mμsec and independence from errors for signals above a given threshold. A.Reiss

621.317.39 : 539.16

4074 RAPID METHODS FOR ASCERTAINING WHETHER THE ACTIVITY OF A WEAK RADIOACTIVE SAMPLE EXCEEDS A PREDETERMINED LEVEL. E.H.Cooke-Yarborough and R.C.M.Barnes.

Proc. Instn Elect. Engrs, Paper 3258 M, publ. July, 1960, 12 pp. To be republished in Vol. 108 B, 1961.

Considers method of determining whether the mean rate of occurrence of random events, such as radioactive disintegrations, is greater or less than some given tolerance rate. The most efficient method is one which makes this determination in the shortest time and with an acceptably low probability of error. Sequential test procedures minimize the sample size by observing the random process until some terminating condition is satisfied. The performance of several sequential tests is investigated, with particular reference to conditions encountered in monitoring radioactive contamination on the hands. The most efficient of these tests is shown to be one which measures the difference between the number of events actually observed and the number expected at the tolerance rate. Under conditions likely to be encountered in routine monitoring for radioactivity on the hands this method gives a fivefold saving in time over the method now in use.

621.317.39 : 539.1.07

4075 RECENT PROGRESS ON MULTICHANNEL TIME ANALYSERS. H.Guillon.

J. Phys. Radium, Vol. 19, No. 1, 100-2 (Jan., 1958). In French.

Various improvements in the accuracy and reliability of time analysers are reviewed. Difficulties encountered with the use of multichannel fast analysers are discussed.

621.317.39 : 531.75

4076 AUTOMATIC RECORDING ELECTROMAGNETIC BALANCE. K.A.Lincoln.

Rev. sci. Instrum., Vol. 31, No. 5, 537-9 (May, 1960).

A simple recording electromagnetic weighing balance has been constructed and operated as a moisture sorption balance and as a flash pyrolysis weight-loss balance. A weight hanging at one end of a lever arm is equilibrated by the counter torque resulting from an armature (same axis of rotation as the lever arm) carrying an electric current flowing perpendicular to a magnetic field. The current is supplied from a d.c. amplifier which is controlled by light falling on a phototube. These components are interconnected in a feedback loop so that the weight of the sample, the amount of light striking the phototube, and the magnitude of the counter-torque current are all sustained in dynamic equilibrium. The instrument has been operated over the 0 to 100 mg range and found to be linear and quite stable with a precision of 0.04 mg.

621.317.39 : 538.2

4077 INSTRUMENTATION APPLICATIONS OF INVERSE-WIEDEMANN EFFECT. J.A.Granath.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 178S-180S (May, 1960).

The principle of the magnetostrictive rod and coil assembly which provides an a.c. voltage output at fundamental excitation frequency, with amplitude proportional to applied torque and phase-reversible with torque direction, is reviewed. The literature on applications of torsional magnetistriction and inverse-Wiedemann effect is limited and widely scattered. A brief summary of some of the literature on instrumentation applications for measurement of torque, force, and other physical quantities is presented. Examples include measurement of torque in rotating shafts, dynamometers, accelerometers, flowmeters, and force balance sensors. For use as a guide in transducer design, a simplified mathematical representation of the torque-signal relationship for one mode of operation is developed from the equations of mechanical strain and applied magnetic field energy. Shape of the torque-signal curve is linear in the vicinity of zero torque, curving off to asymptotes at the extremes. Means for extending the results of tests on standard samples to design guides on rod diameter, coil turns, and excitation frequency are suggested.

621.317.39 : 621.374.32

HIGH SPEED MEASUREMENT OF PRESSURE UTILIZING TRANSISTORIZED BUFFER CORE MEMORY. See Abstr. 3556

621.317.41

4078 A TECHNIQUE FOR REDUCING ERRORS IN PERMEABILITY MEASUREMENTS WITH COILS.

B.L.Danielson and R.D.Harrington.

Proc. Inst. Radio Engrs, Vol. 48, No. 3, 365-6 (March, 1960).

When evaluating the initial permeability using coils wound on toroidal samples of rectangular cross-section considerable errors are introduced unless a fairly large number of turns are used. The errors are presumably due to flux leakage and current sheet corrections. It has been found that the sum of these errors is independent of the magnitude of the permeability. Formulae are given, enabling this correction to be applied, when coils with quite a small number of turns (which can be opened) can be used to facilitate the measurement. A.P.C.Thiele

621.317.42

4079 NETWORK ANALOGUE AND GRAPHICAL METHODS FOR THE DETERMINATION OF MAGNETIC FIELDS WITH LOCAL PERMEABILITY VARIATIONS.

P.A.Tschopp and A.H.Frei.

Arch. Elektrotech. (Berlin), Vol. 44, No. 7, 441-54 (1959). In German.

The vector relationships are derived for fields in materials having uniform and variable permeability, and methods for designing resistor networks for simulating these field structures are discussed. A practical example is given. This is followed by graphical methods, also with examples based on the above theory. K.C.Garner

621.317.431

4080 INDUSTRIAL HYSTERESIGRAPH USES D.C. INTEGRATION. R.R.Bockemuehl and P.W.Wood.

Electronics, Vol. 33, No. 13, 70-1 (March 25, 1960).

The instrument is based on the usual principle of deriving H from a series resistor carrying the magnetizing coil current, and B from a voltage integrator connected across a secondary coil on the sample. The integrator is a d.c. amplifier with mutual inductance (50 mH) feedback. It comprises a galvanometer-photocell amplifier with a voltage gain of 3×10^6, followed by a valve amplifier with direct coupling through a neon tube network, and a simple low-pass filter to suppress oscillation. The galvanometer-photocell amplifier is mounted on a 140 lb Fe block to reduce noise due to vibration, and when operated near heavy rotating machinery the noise level is equivalent to 2.5 Maxwell-turns. The integrating time-constant of the combined amplifier is 10^4 sec. Provision is made for compensating thermo-e.m.f's. in the input circuit. Curves are drawn by an X-Y recorder giving f.s.d. with 5-10 mV and 1-2 sec. Full-scale reading can be adjusted continuously from 250 to 500 000 Maxwell-turns. The time taken to record a complete loop is 10–30 sec. C.F.Pizzey

621.317.44 : 538

4081 PRACTICAL HYSTERESIGRAPH. R.R.Bockemuehl and W.E.Sargeant.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 180S-182S (May, 1960).

A relatively low-cost hysteresigraph has been developed which is suitable for both laboratory and industrial application. The instrument utilizes standard component parts and employs mutual inductance feed-back to perform the necessary integrating operation. The instrument is reasonably insensitive to environment and permits direct recordings of hysteresis loops and magnetization curves to be made in less than one minute. Both theoretical and practical considerations of the instrument are presented.

621.317.44 : 538

4082 SIMPLE RECORDING TORQUE MAGNETOMETER. P.W.Neurath.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 184S-185S (May, 1960).

A recording torque magnetometer has been designed and constructed, using commerically available components in conjunction with commonly available laboratory equipment. It appears to be much simpler than any described heretofore and needs no calibration. The sample disk is mounted at the end of a shaft which is supported in two fixed radial nonmagnetic precision ball bearings of low starting torque. The other end of the shaft carries a 10 cm long lever arm which exerts a force on a Statham Instruments, Inc., 0.3 oz transducer (Model G7A). The relative rotation of sample to magnet is converted to an electrical signal of any convenient magnitude by use of a 360° continuous rotation Helipot potentiometer. Both torque and rotation signals are recorded on an XY mV recorder. The electrical circuits consist only of batteries and resistors and the factory supplied transducer calibration is entirely adequate. The assembly can be rotated manually. At $\pm 40 \times 10^3$ ergs full scale, corresponding to an output of ±5 mV, errors are about 1%. Slight alterations in the design to cover full scale ranges from 10^4 to 10^6 ergs or more are possible.

621.317.44 : 534.8 : 538

4083 MAGNETIC FIELD MEASUREMENT USING ULTRASONICS. R.J.Radus.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 186S-187S (May, 1960).

The detection and measurement of magnetic field intensity for purposes of field plotting and uniformity studies is a most important consideration in the field of magnetics. Field plotting and uniformity studies have been conducted on certain sizes of magnetic geometries with rotating coil instruments and Hall generators and quartz crystal magnetometer. The obvious limit of such devices is their minimum resolving power which can be defined in terms of sampling area and minimum air gap. For the rotating coil instruments, the minimum air gap is $\frac{1}{4}$ in. and the sampling area is roughly 1.2×10^{-2} in^2. Commercially available Hall generators which can be fitted into air gaps of approximately 0.011 in. have sampling areas in the order of 3.2×10^{-3} in^2. Hall generators with sampling areas in the order of 10^{-7} in^2. have been reported in the literature. Minimum thickness of this type device is presumably less than 0.01 in. The more recent work (see Abstr. 5125 A of 1958; J. appl. Phys., Vol. 27, 407-8, March, 1958) with the vibrating quartz crystal magnetometer has been used to measure flux density normal to the surface of permanent magnets. The sampling area of this type of equipment is 0.56×10^{-6} in^2. The minimum thickness of this equipment has not yet been reported in the literature. The flux-measuring equipment being described in this paper has a sampling area of approximately 6.25×10^{-6} in^2. and a sensitivity of approximately 0.01×10^{-3} V/gauss. The probe consists of a single turn inductor of length $\frac{1}{4}$ in. which vibrates ±0.000 05 in. The inductor is fastened to a probe of 0.01 in. thickness and the 0.0001 in. motion is perpendicular to this 0.01 in. probe thickness. The physical geometry and size of this probe permits measurements in a variety of positions relative to the magnetic circuit. This type of probe is applicable for measuring flux density in air gaps as small as 0.017 in. The driving device for this equipment is a 60 kc/s magnetostrictive transducer. The complete probe consists of the transducer reactor, a coupling bar of nonmagnetic stainless steel and the thin strip of the nonmagnetic stainless steel to which the inductor is fastened. The geometry and size of this thin strip can be changed to accommodate variations in both inductor length and displacement.

621.317.44 : 538.1

4084 EXPERIMENTAL FLUX PATTERN DETERMINATION IN MAGNETIC CORES. R.L.Ward.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 192S-193S (May, 1960).

The difficulties in determining the quiescent flux patterns in nonlinear magnetic structures is considered and two techniques are briefly described for measuring these patterns in magnetic cores etched from sub-mil thicknesses of 4-79 molybdenum Permalloy. Both methods utilize a sensing loop formed by moveable surface probes and a part of the core itself, which conductively completes the sense circuit. A detailed description of the measuring apparatus and the testing technique is given, and the graphical procedure for plotting the flux configuration of a two-aperture multi-path core is outlined. Finally, additional applications are enumerated.

621.317.44 : 538.1

4085 METHOD FOR MEASURING IRON LOSSES IN ELLIPTICALLY POLARIZED MAGNETIC FIELDS. F.J.Young and H.L.Schenk.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 194S-195S (May, 1960).

A method for measuring iron losses in elliptically polarized magnetic fields has been devised. The fields are produced in a laminated one-inch cubic specimen by the superposition of two mutually perpendicular magnetic fields whose magnitudes and time phase angles can be varied. Orthogonal fields are obtained by the use of two "C" cores with air gaps large enough to contain the specimen. The flux density is ascertained from the voltages induced in two coils wound on the specimen with axes parallel to the two field components. The iron loss is determined by measuring the heating transient in the specimen. In addition, the anisotropy in losses due to alternating magnetic fields can be determined as a special case of elliptically polarized field excitation. The loss data obtained by this method agree with the results given by the standard Epstein test to within 15%.

621.317.61

4086 MEASUREMENT OF TRANSISTOR CHARACTERISTIC FREQUENCIES IN THE 20-1000 Mc/s RANGE. J.Bickley.

Proc. Instn Elect. Engrs, Paper 3206 M, publ. May, 1960 (Vol. 107B, 301-5).

Apparatus is described for the rapid determination of the cut-off frequencies f_1 and f_α, of transistors in the 20-1000 Mc/s range. Accurate measurements at these frequencies are made possible by the application of transmission-line techniques to the method of comparing the high-frequency voltages which appear across small resistors connected to two leads of the transistor. Methods are adopted which separate the measuring circuits from the input circuit and make the design of the latter non-critical. The relative accuracy of f_1 and f_α measurements is discussed, and it is concluded that the inherently more accurate f_1 measurement should have an error within ±5%, whereas the error in f_α is probably 2-3 times higher. A few typical measurements are given.

621.317.61 : 621.352 : 541.13

THE CHARACTERISTICS CURVES FOR THE ELECTRICAL RESISTANCE OF GALVANIC CELLS. See Abstr. 3483

INSTRUMENTS
MEASURING APPARATUS

621.317.7 : 621.383

4087 THE USE OF LIGHT-SENSITIVE COMPONENTS IN THE CONSTRUCTION OF OPTICAL INSTRUMENTS. P.Görlich, A.Krohs and H.J.Pohl.

Nachrichtentechnik, Vol. 9, No. 9, 400-4 (Sept., 1959). In German.

The uses of photo-electric components in apparatus for many branches of science are widespread and various, often requiring special development. Commenting on the increase in the use of photo-electric receivers in the construction of optical instruments the author briefly surveys the general fields using light-sensitive components before summarizing the main applications of photo-electric components. Receivers for pictorial recording or transmission of images, such as picture translators, are described, and finally optical instruments, photometers, spectrophotometers etc., incorporating photo-electric components are dealt with.

29 References. W.A.Walker

621.317.7 : 537.7

4088 SHIELDED COAXIAL LEADS FOR LOW-TEMPERATURE ELECTRICAL MEASUREMENTS. N.L.Brown and R.N.Barfield.

Rev. sci. Instrum., Vol. 31, No. 5, 517-19 (May, 1960).

The problem of making electrical contact to apparatus at very

low temperatures is discussed, with particular reference to dielectric-constant measurements in a situation where multiple shielding is required. Examples are given of easily constructed rigid electrode leads suitable for use at low temperatures, which have low thermal conduction, low and stable inter-conductor capacitance and conductance, and which provide for more than two coaxial conductors.

621.317.715

4089 MOVING-COIL AND MOVING-MAGNET GALVANOMETERS, OPTIMUM OPERATING CONDITIONS AND FACTORS OF MERIT. P.Nenning.

Arch. Elektrotech. (Berlin), Vol. 44, No. 5, 279-96 (1959). In German.

A discussion of the factors which determine and limit the power, current and voltage sensitivities and the performance of m.-c. and m.-m. galvanometers. A brief treatment of vibration galvanometers is included. C.F.Pizzey

621.317.729.3 : 621.391.823

4090 AN INSTRUMENT FOR MEASUREMENT OF INTERFERENCE FIELD STRENGTH IN THE FREQUENCY RANGE 30 TO 225 Mc/s. H.Lorenz.

Nachrichtentechnik, Vol. 10, No. 1, 23-8 (Jan., 1960). In German.

A general description of the FMG2 instrument developed by the VEB Funkwerk, Dresden, which operates as a calibrated heterodyne receiver. A block diagram shows the arrangement of the various units. The total frequency range is covered on 8 scales and the uncertainty of the frequency indication is $< \pm 1\%$, while the frequency constancy is better than 1×10^{-3} for 60 min. after a 5 min. warm-up period, a quartz-controlled oscillator being used for the second mixer stage. A detailed account is given of the working of the instrument and of the method of calibration. A.Wilkinson

621.317.733

4091 THE ACCURACY OF IMPEDANCE MEASUREMENTS IN A.C. BRIDGES. H.H.Wolff.

J. Franklin Inst., Vol. 269, No. 4, 299-313 (April, 1960).

The accuracy of impedance magnitude and phase measurements in a.c. bridges is derived as a function of the null instrument sensitivity and a bridge characteristic. The influence of the bridge-length ratio and its phase angle on the measurement accuracy is treated in detail. It is especially shown that for a bridge-length ratio amount of 1, that is, $|z_1| = |z_2|$, the obtainable accuracy improves as the phase angle $\sphericalangle z_1, z_2$ increases. It is furthermore shown that the maximum impedance magnitude error and the maximum phase error occur at different bridge adjustments. Formulae for the phase angles between null voltage and bridge voltage for maximum impedance magnitude error and for maximum phase error are derived.

621.317.733 : 537.2

4092 R.F. ADMITTANCE BRIDGE FOR LIQUID-DIELECTRIC MEASUREMENTS. R.G.Bennett.

J. sci. Instrum., Vol. 37, No. 6, 195-7 (June, 1960).

An admittance bridge is described suitable for the measurement of the complex permittivity of liquid dielectrics at frequencies between 100 kc/s and 3 Mc/s. The unknown capacitance is compared directly with a standard capacitor, while the conductance arm may be simply calibrated on a direct current supply. Component values are given suitable for use with a cell having an empty capacitance of 5 pF. No Wagner earth is necessary when using a 3-terminal cell, since the balance condition is independent of admittances between the electrodes and the guard electrode.

621.317.74 : 538.56

4093 HIGH RESOLUTION MILLIMETER WAVE FABRY–PEROT INTERFEROMETER. W.Culshaw.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 182-9 (March, 1960).

The design and operation of a microwave Fabry–Perot interferometer at wavelengths around 6 mm is described. This uses reflectors which are simple, easy to make, and which are capable of scaling for operation at short wavelengths in the ultramicrowave region. With power reflection coefficients around 0.999, very sharp fringes and Q values around 100 000 were obtained on the interferometer. Effects of diffraction in the interferometer are considered, and wavelength measurements with this particular interferometer indicate that accuracies of 0.04% are obtained without any diffraction correction. Advantages of such an interferometer for ultramicrowaves are that the component parts are large compared with the wavelength, the effects of diffraction decrease with the wavelength, and the problem of maintaining a high Q with a single mode of propagation and a structure of adequate size is made much easier. Such an interferometer forms the cavity resonator for ultramicrowaves. It can thus be used for such conventional purposes as wavelength measurements, wavelength spectral analysis, dielectric constant, and loss measurements, or as the cavity resonator for frequency stabilization, or as the cavity resonator for a millimeter- or submillimeter-wavelength maser.

621.317.74

4094 RUSSIAN TEST EQUIPMENT FOR AUDIO, RADIO, AND MICROWAVE MEASUREMENTS. B.O.Weinschel.

I.R.E. Trans Instrumentation, Vol. I-8, No. 3, 67-78 (Dec., 1959).

Photographs and brief descriptions are presented of thirty measuring and test equipments which were shown at an exhibition in New York City in July 1959.

621.317.74 : 539.1.07

4095 A DISTRIBUTED [PARAMETERS] PULSE-HEIGHT ANALYSER. A.Boucherie and J.Mey.

J. Phys. Radium, Vol. 19, No. 1, 98-9 (Jan., 1958). In French.

Presents a new type of fast multichannel pulse-height analyser using the principle of distributed circuits. A description of the circuits employed in the construction of a model with five channels is given. The resolving time of this device is 0.2 μs.

621.317.74

4096 RATIO TRACING RECEIVER FOR U.H.F. MEASURING SETUPS. M.Niedereder.

Siemens - Z., Vol. 34, No. 3, 142-6 (March, 1960). In German.

The instrument is suitable as a receiver for u.h.f. measuring set apparatus and in particular for frequency-sweep measuring apparatus using an oscillator that can be modulated with 1 kc/s. It automatically forms the ratios of two voltages gained via external measuring rectifiers that are part of the u.h.f. measuring equipment, and is calibrated in level differences. Its measuring range extends from 0 to 40 dB. The measurement, e.g. attenuation or reflection coefficient, is traced as a function of frequency on a 13-cm c.r.t. Operating principles and application are described.

621.317.74

4097 LEVEL METERING SETUP WITH A.F.C. FOR RANGE FROM 30 kc/s TO 15 Mc/s. A.Neumann.

Siemens-Z., Vol. 34, No. 5, 315-20 (May 1960). In German.

A versatile level-metering setup has been developed for modern broadband communications systems (multichannel telephony and television over coaxial cables or radio relay systems). Its particular advantages reside in the high frequency accuracy and stability secured through use of a spectrum oscillator with a.f.c. for multiples of 100 kc/s and an interpolation oscillator with which the test frequency can be varied by increments up to $f = 100$ kc/s within the overall range. The frequency error is $2 \times 10^{-8} + 300$ c/s. With a level oscillator and level meter available, the main and vernier controls of the receiver can be synchro-tuned from the oscillator. The level range extends from −110 to +20 dB. The level meter can also be used to advantage for noise-level measurements and as a pilot receiver, and can be used with other devices to form a frequency-sweep measuring setup.

621.317.75

4098 BATTERY OPERATED TRANSISTOR OSCILLOSCOPE. O.Svehaug and J.R.Kobbe.

Electronics, Vol. 33, No. 12, 80-3 (March 18, 1960).

Designed for use where conventional power is not available, the circuits follow well established practice except for the charger circuit, power sources and a deflection-blanked c.r.t. Using 39 transistors and 3 valves the response is from d.c. to over 5 Mc/s. An interesting point is the proper choice of RC time-constant compensation to avoid large l.f. input signals causing heating of the transistors which increases l.f. gain. The total consumption is 9.2 W of which nearly half is used to heat the valves. On battery the instrument will operate for 5 hrs. Nickel-cadmium batteries are used with a special charging circuit which switches off when the battery reaches a certain temperature. A block-schematic, photos and full circuit diagrams are given. B.B.Austin

621.317.76 : 621.373.5 : 538.561 : 529.786

4099 FREQUENCY VARIATIONS OF QUARTZ OSCILLATORS AND THE EARTH'S ROTATION IN TERMS OF THE N.P.L. CAESIUM STANDARD.

L.Essen, J.V.L.Parry and J.McA.Steele.
Proc. Instn Elect. Engrs, Paper 3002 M, publ. Aug., 1959 (Vol. 107 B, 229-32, 232-4 May, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 7145 of 1959.

621.317.77

4100 PRECISION PHASEMETER FOR C.W. OR PULSED U.H.F. R.T.Stevens.
Electronics, Vol. 33, No. 10, 54-7 (March 4, 1960).

The apparatus, operating in the band from 100 to 500 Mc/s, will measure the phase between two signals to within 0.2 and 0.5 degrees for c.w. and pulsed c.w. respectively. By a change in i.f. the same method will measure down to 20 Mc/s. With suitable pre-amplifying equipment, operation up to X band is possible. No manual adjustments are needed for initial calibration. Output is in digital form, giving phase difference directly in degrees. Input attenuators make it possible to handle signal levels in the range +40 to −80 dBm; the difference in signal levels, however, must be limited to 30 dB. Circuits are described and illustrated in some detail. A.Reiss

621.317.77

4101 A TRANSFER FUNCTION ANAYLSER. J.G.A.v.Breugel, P.J.Rademakers and C.M.Verhagen.
Instrum. Pract., Vol. 14, No. 1, 43-7 (Jan., 1960).

A Dutch T.F.A. is described which utilizes two wattmeters in a fairly conventional way to indicate the in-phase and quadrature components of the output signal of a system under test. The reference oscillator is electronic and two-phase for test signals above 1 c/s. In the range 0.001 to 1 c/s a velodyne-driven sine-cosine potentiometer is used instead, and associated with this is a novel sampling procedure which provides instantaneous readings at these very low-frequencies, instead of the averaged signal used in the upper range. Sampling is arranged using a cam, synchronously coupled with the velodyne, to allow four capacities to be charged up sequentially at $\omega t = 60^\circ$, 120°, 150° and 210°. By suitably operating these sampled voltages the amplitude and phase of the output can be derived. A comprehensive discussion on the probable errors in the system is given. K.C.Garner

621.317.772.029.6

4102 MEASUREMENT OF RELATIVE PHASE SHIFT AT MICROWAVE FREQUENCIES.
C.A.Finnila, L.A.Roberts and C.Süsskind.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 143-7 (March, 1960).

A method is described for measuring the relative phase-shift of microwave devices, such as travelling-wave tubes, which utilizes the serrodyne technique to transfer the measurements into the a.f. range. The method is used to measure the phase shift incidental to the variation of the d.c. potentials applied to the several electrodes of a 2 to 4 Gc/s travelling-wave tube. This method is particularly useful in coaxial systems, where accurately calibrated phase-shifters (and attenuators without phase-shift) are not available.

621.317.785

4103 THE APPLICATION OF STATISTICAL METHODS TO THE CHECKING OF REPAIRED METERS. E.Kehler.
Frequenz, Vol. 14, No. 1, 1-5 (Jan., 1960). In German.

A discussion, with worked examples, of the principles of checking meters by random selection of samples. C.F.Pizzey

621.317.79

4104 CORRECTION OF ERRORS DUE TO THE DYNAMIC CHARACTERISTICS OF MEASURING APPARATUS.
J.M.Max.
Automatisme, Vol. 4, No. 12, 468-73 (Dec., 1959). In French.

Measurement of transfer functions is discussed, and a simple instrument, termed the dérivimètre, for measuring the slope of a curve, is described. It consists of a protractor, with a vernier to reading to ~0.1°, and a small mirror and lens carried on a movable radial arm. An apparatus for measuring the fuel consumption of aero engines is outlined. It consists of a turbine rotor mounted in the fuel line, with a permanent magnet embedded in one of the rotor blades. The magnet induces a voltage pulse in an adjacent fixed coil when the rotor turns. The pulses are converted by electronic means to a form suitable for application to an instrument indicating rate of fuel flow, and a counter showing the quantity of fuel consumed. The inertia and friction torque of the rotor are very low compared with the driving torque, and its time constant is negligible. The time constant of the electronic integrating system is much greater, and affects the accuracy of measurement with changing rates of flow. Correction of these errors is discussed. C.F.Pizzey

621.317.79

4105 MEASUREMENTS ON EXPOSURE METERS. J.Krochmann.
Lichttechnik, Vol. 12, No. 4, 203-7 (April, 1960). In German.

The author examined a large number of meters made by different manufacturers, with particular reference to (a) the angle of acceptance and the relation between sensitivity and the angle of incidence of the light; (b) the relation of response to object luminance; (c) the effect of colour of the light; and (d) fatigue. Under (a) the angle was found to range from 18° to 46° and there was considerable variation in the relation between meter reading and the effect on the camera film (35 mm). Under (b), the relation between reading and luminance was logarithmic but the base of logs, ideally 2, varied from about 1.7 to 2.24. The effect under (c) was small, except for sodium or mercury (uncorrected) light. J.W.T.Walsh

621.317.794

4106 DESCRIPTION AND PROPERTIES OF VARIOUS THERMAL DETECTORS.
R.DeWaard and E.M.Wormser.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1508-13 (Sept., 1959).

Commercially available thermocouples, bolometers and pneumatic detectors are compared. C.Hilsum

MAGNETIC DEVICES AND MATERIALS

621.318

4107 APPARENT PERMEABILITY AND INTRINSIC PERMEABILITY AT CENTIMETRIC WAVELENGTHS.
R.Vautier and A.J.Berteaud.
C.R.Acad. Sci. (Paris), Vol. 250, No. 14, 2527-9 (April 4, 1960). In French.

The concept of instrinsic permeability is considered and the work of Spencer et al (Abstr. 1356 of 1957) is criticized within this context. It is shown that the instrinsic permeability as usually calculated is not independent of the specimen configuration, and explanations for this are suggested. S.A.Ahern

621.318 : 621.314.2

INFLUENCE OF COPPER ON THE WATT LOSSES OF TRANSFORMER STEEL. See Abstr. 3989

621.318.1 : 621.374.32

4108 MILLIMICROSECOND MAGNETIZATION REVERSAL IN THIN MAGNETIC FILMS.
W.Dietrich and W.E.Proebster.
I.B.M. J. Res. Developm., Vol. 3, No. 4, 375-6 (Oct., 1959).

Switching times have been measured by using special pulse equipment, including a sampling oscilloscope, with an overall response time of about 0.5 mμsec. Flux changes of 1.5 mμsec were observed for the transverse flux component as well as for the longitudinal one. E.W.Kellermann

621.318.1 : 621.374.32 : 539.2 : 538.1

4109 EFFECT OF GEOMETRY ON THICK FILM TOROIDS. J.C.Sagnis, Jr, M.Teig and R.L.Ward.
J. appl. Phys., Suppl. to Vol. 31, No. 5, 190S-191S (May, 1960).

In the study of thick-film (1-20 μ) magnetic circuits, it has been found that thick film cores of certain sizes could not be completely switched if a concentrated drive winding was used. In addition, the induced voltages differed in waveshape as a function of the location of the sense windings with respect to the concentrated drive winding. Both phenomena were obviously detrimental to the "normal" operation of the device as a magnetic storage or logical element. Studies of these phenomena were conducted using planar thick films toroids, photo-etched from $\frac{1}{4}$-mil and $\frac{1}{2}$-mil thick Square Loop Hy-Mu 80. From the results of these studies, qualitative explanation of the aforementioned phenomena is offered in the form of a three-part flux-pattern model.

621.318.1 : 621.374.32 : 538.2 : 539.2

FAST SWITCHING BY DOMAIN WALLS IN FERRITES. See Abstr. 3573

621.318.1 : 621.374.32 : 538

MINIATURE MEMORY PLANES FOR EXTREME ENVIRONMENTAL CONDITIONS. See Abstr. 3566

621.318.12 : 621.374.32 : 538

DEVELOPMENT OF HIGH-SPEED COINCIDENT CURRENT MEMORY CORES. See Abstr. 3564

621.318.12 : 621.374.32

EXPANDABLE RANDOM ACCESS MEMORIES. See Abstr. 3565

621.318.12 : 621.374.32 : 538

ELASTIC SWITCHING PROPERTIES OF SOME SQUARE LOOP MATERIALS IN TOROIDAL STRUCTURES. See Abstr. 3576

621.318.132 : 539.2 : 538.27

4110 L-BAND FERROMAGNETIC RESONANCE EXPERIMENTS AT HIGH PEAK LEVELS.

E.Schlömann, J.H.Saunders and M.H.Sirvetz.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 96-100 (Jan., 1960).

Ferromagnetic resonance absorption at high peak power levels has been observed at 1300 Mc/s in yttrium–gadolinium garnets and in a nickel ferrite–aluminate. In agreement with theoretical predictions, the critical field characterizing the onset of nonlinear effects in a series of yttrium–gadolinium garnet disks of a given shape was found to be very sensitively dependent on the gadolinium content. Similarly, for samples of a given composition, the critical field strength was sensitively dependent on the shape of the sample in agreement with theoretical predictions. At moderate power levels the susceptibility varies linearly with the square of the r.f. magnetic field strength over an appreciable range. This result can be understood in terms of an extension of Suhl's theory. The results can be used to predict the high-power performance of these materials when used in isolators.

621.318.132 : 539.2 : 538.27

4111 HIGH POWER FERROMAGNETIC RESONANCE AT X-BAND IN POLYCRYSTALLINE GARNETS AND FERRITES. J.J.Green and E.Schlömann.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 100-3 (Jan., 1960).

Resonance experiments were performed at X-band on spherical samples of polycrystalline yttrium garnet, yttrium–gadolinium garnet, yttrium–holmium garnet and nickel–cobalt ferrite. The r.f. field strength extended up to 60 Oe. In the case of yttrium garnet the samples differed considerably in density and hence in linewidth. At fairly low power levels the susceptibility at resonance varied linearly with the square of the r.f. magnetic field strength. At high power levels the susceptibility was inversely proportional to the amplitude of the microwave magnetic field. The "spin-wave linewidth" ΔH_k was inferred by extrapolation from the behaviour at very high powers. It was found that ΔH_k is, to a large extent, independent of the linewidth ΔH observed by the usual low power experiments. In particular ΔH_k was found to be essentially the same (approximately 4 Oe) for all yttrium iron garnets (single crystals and polycrystals with linewidth varying between 1.8 Oe and 450 Oe). On the other hand, ΔH_k increased very rapidly if the yttrium was partially substituted by holmium ($\Delta H_k \sim$ 11 Oe for 1% substitution).

621.318.132

4112 ON THE DEPENDENCE OF THE PHYSICAL PARAMETERS OF FERRITES ON THE SINTERING TEMPERATURE. H.Hultschig.

Nachrichtentechnik, Vol. 9, No. 9, 390-1 (Sept., 1959). In German.

Briefly examines the dependence of the permeability, the resistivity and the eddy-current coefficient on the sintering temperature for an unspecified ferrite. F.F.Roberts

621.318.132

4113 ELECTRICAL MEASUREMENTS ON MAGNETICALLY SOFT FERRITES.

H.Heuniger, H.Rudloff and G.Engelhardt.

Nachrichtentechnik, Vol. 9, No. 9, 392-5 (Sept., 1959). In German.

Briefly reviews the types of radio-frequency and microwave characteristics, and of square-loop switching characteristics, obtainable with ferrites, and summarizes some methods of measuring their parameters. F.F.Roberts

621.318.132

4114 A STUDY OF FERRITES IN MICROWAVE APPLICATIONS. A.Vassiliev.

Onde elect., Vol. 39, 207-14 (March, 1959). In French.

Elementary theory on the behaviour of ideal ferrites with respect to wave propagation and losses is given. Modifications to these concepts are then discussed in relation to practical materials, characteristics measurements and their parameter variations with temperature, magnetic field etc. Lastly, a table is given of the various applications of ferrites in the microwave field in which the dominant characteristics required for each application are listed. 18 references, 7 illustrations. A.Reiss

621.318.132

4115 RECENT DEVELOPMENTS IN MICROWAVE APPLICATIONS OF FERROMAGNETIC AND FERROELECTRIC MATERIALS. F.R.Morgenthaler.

Onde elect., Vol. 39, 241-4 (March, 1959). In French.

A short survey of some of the domains of solid-state physics applied to microwave research. In the fields of ferrimagnetics, investigations on Yttrium garnets are described with particular reference to a resonance-absorption isolator operating below 1000 Mc/s and a theoretical analysis of a ferromagnetic oscillator. In the domain of ferroelectricity the interest is centred on evaluation of microwave properties of known materials with a view to their use in electrostatically controlled modulators, dephasers and attenuators. Principal results are given of a theoretical study on ferroelectric modulators as well as a numerical example. Combinations of ferroelectric and ferromagnetic materials offer interesting possibilities at microwaves: a brief description is given of a device utilizing the Faraday effect which is controlled electrostatically. 8 references, 9 illustrations. A.Reiss

621.318.2 : 621.374.32 : 538

4116 LOCALIZED FIELD PERMANENT MAGNET ARRAYS. H.L.Stadler.

J. appl. Phys., Suppl. to Vol. 31, No. 5, 196S-197S (May, 1960).

Very short bar magnets can be grouped into linear arrays in such a way as to give a more localized field than does a single magnet of about the same size. Shaping the field from small magnet arrays is particularly important in the design of permanent-magnet memories where the information is stored by the presence or absence of permanent magnets. To achieve high information density it is necessary to design magnet structures with very localized fields. Measurements of the response of a memory sensing element as a function of its distance from various magnets show that a linear array has a much stronger effect when very close to the sensor than does a single magnet of similar size and dipole moment.

621.318.37 : 538.1

4117 SOLENOID PAIR FOR PRODUCTION OF A SEVENTH-ORDER EXTERNAL FIELD.

J.A.Jungerman and C.G.Patten.

Rev. sci. Instrum., Vol. 31, No. 2, 171-2 (Feb., 1960).

The magnetic field is calculated for a coaxial pair of solenoids having an external axial field which decreases as the inverse seventh power of the distance from the solenoid centres. The effect of finite coil thickness is discussed.

621.318.38 : 621.34

FORCES ARISING IN MAGNETIC FLUIDS. See Abstr. 3384

621.318.381 : 621.34

TRANSIENT PROCESSES IN THE MAGNETIC CIRCUITS OF ELECTROMAGNETIC CLUTCHES. See Abstr. 3387

621.318.381 : 621.34

UNIVERSAL RELATIVE CHARACTERISTICS AND CURRENT LOCI FOR AN ASYNCHRONOUS CLUTCH WITH HEAVY FERROMAGNETIC ARMATURE. See Abstr. 3385

621.318.381 : 621.34

SOME SOLID-ROTOR ASYNCHRONOUS CLUTCH DESIGN PROBLEMS. See Abstr. 3386

INDUCTORS . REACTORS RELAYS

621.318.5

4118 NEW POSSIBILITIES OFFERED BY THERMAL RELAYS. J.Caire.

Automatisme, Vol. 5, No. 2, 45-8 (Feb., 1960). In French.

The necessity for designing thermal relays operating on temperature differential to avoid dependence on ambient temperature is pointed out. The design of such relays, their advantages compared with standard electromagnetic relays and their applications are described. T.Horrocks

621.318.56

4119 THE PROBLEM OF DIMENSIONS OF ELECTROMAGNETIC [RELAY] ELEMENTS. B.S.Sotskov.

Avtomat. i Telemekh., Vol. 19, No. 9, 849-54 (1958). In Russian.

Treats basic correlations between the efficiency of an electromagnetic system with its magnetic, electric and thermal parameters and its lifetime.

621.318.56

4120 SYNTHESIS OF SYSTEMS WITH STEP SELECTORS. G.Ioanin.

Avtomat. i Telemekh., Vol. 19, No. 9, 855-63 (1958). In Russian.

The construction and action of uniselector switches is described. Step-selector action is described by functions determined by multiposition elements. Some systems with step selectors are synthesized.

621.318.56

4121 MAGNETIC CIRCUIT OF HERMETICALLY ENCLOSED CONTACTS IN PROTECTING GAS ATMOSPHERE. H.Rensch.

Nachrichtentech.Z. (N.T.Z.), Vol. 12, No. 12, 625-9 (Dec., 1959). In German.

The Standard Electrik Lorenz "Herkon" relay developed in the Bell Laboratories (U.S.A.), consists essentially of a pair of 50/50 Ni–Fe high permeability magnetic reeds sealed lengthwise into a glass tube with a small area overlap (3 mm^2) and a narrow gap at the centre. The tube is filled with an inert gas before sealing, and for use as a relay is inserted axially into a solenoid. The magnetic circuit through the centre is completed via a low reluctance iron sleeve enveloping the solenoid except for axial holes. The magnetic circuit is discussed in detail and presented mathematically, with graphs of performance in terms of contact gap, response flux and response power. Relays with up to four contact pairs have been made, operating powers ranging from 90 to 185 mW. For improved performance, contacts may be given a gold-diffused layer by heat treatment. Advantages claimed for the new contacts are short switching times on account of the small masses involved, optimum adjustment and the possibility of automatic production. W.J.Mitchell

621.318.56.066.6

4122 REDUCTION OF NOISE IN LOW CURRENT APPARATUS BY GILDING THE CONTACTS BY MEANS OF SPARKS. N.Belopitov.

Nachrichtentechnik, Vol. 10, No. 4, 172-7 (May, 1960). In German.

Noise resulting from imperfect contacts, in, for example, telephone apparatus, can be reduced by gilding them. In the method here described, the gold is deposited on the contact by means of a spark. P.M.Davidson

621.318.563.2

4123 THE SINGLE-REED RESONANCE RELAY, A VERSATILE CONSTRUCTION COMPONENT. W.Rauch and E.Ueberschuss.

Electrotech. Z. (E.T.Z.) A, Vol. 81, No. 8, 300-5 (April 11, 1960). In German.

Resonance relays with mechanical vibrators are superior to electrical filter circuits for separation and evaluation of signals below 1 kc/s. Single-reed relays are simpler than double-reed or tuning-fork types, and they can be easily tuned and fitted into a compact magnetic circuit. The frequency response can be adjusted to a very narrow bandwidth. Constructional details of single-reed relays, their physical properties, including effect of temperature variation, shocks, acceleration and magnetic screening are described. Relays are hermetically sealed and therefore are small, light and especially suited to modern miniature techniques. A member of cases of possible application is also given. W.J.Grek

ELECTROSTATICS . CAPACITORS

621.319.4

4124 A MINIATURE LACQUER-FILM CAPACITOR. H.G.Wehe and J.K.Werner.

Bell Lab. Record, Vol. 38, No. 1, 19-22 (Jan., 1960).

The capacitor described has a value of 0.025 μF and a working voltage of 50 V. The dielectric consists of a thin polystyrene film deposited on a vacuum-deposited zinc electrode, which, in turn, is supported on lacquered paper. The upper temperature limit is stated to be 75° C. K.W.Plessner

621.319.45

4125 ELECTROLYTIC CAPACITORS WITH ADIPIC ACID ELECTROLYTE. G.Hahn.

Nachrichtentechnik, Vol. 9, No. 7, 300-3 (July, 1959). In German.

In the common ammonium borate–ethylene glycol electrolyte used for aluminium electrolytics, boric acid has been replaced by adipic acid. The viscosity and its temperature coefficient are lowered, producing better low-temperature performance e.g. reduction in capacitance at –20° C is reduced from 28% with boric acid to 9% with adipic acid electrolyte. Stability is shown to be adequate by life-tests. K.W.Plessner

621.319.45

4126 PROBLEMS IN THE PREPARATION OF ANODES FOR ELECTROLYTIC CAPACITORS. W.Prang.

Nachrichtentechnik, Vol. 9, No. 7, 303-6 (July, 1959). In German.

Deals with aluminium electrolytics and describes methods of etching (to obtain surface magnification) and anodizing of the foil in current use. The merits of preforming in oxalic acid or of a pretreatment to produce a layer of Boehmite are discussed, the former method being preferred. It is stated that a surface magnification of 5 should not be exceeded to obtain the best electrical properties. K.W.Plessner

621.319.5 : 537.52

4127 SUPPRESSION OF COUNTER-EMISSION IN COMPRESSED AIR. APPLICATION TO HIGH-VOLTAGE GENERATORS AND ELECTROFILTERS. Nguyen-Trinh Dzoahn.

C.R.Acad. Sci. (Paris), Vol. 250, No. 10, 1811 (March 7, 1960). In French.

A formula given previously (see Abstr. 2865 of 1960) is amended as a result of defining the rate of counter-emission, a term in the formula, explicitly. A.E.Kay

621.319.7

4128 THE ELECTRIC SAND STORM AND RELATED PHENOMENA. D.Müller-Hillebrand.

Elektrotech. Z.(E.T.Z.) A, Vol. 80, No. 24, 837-44 (Dec. 11, 1959). In German.

An example is quoted of the electrification by a dust storm and, from previously published experimental investigations, the physical mechanism of such an electrification process is examined as a function of the size of the dust particles. Large-scale charge separation is suggested to be due to gravity, as in the case of a thundercloud. The daily variation of the earth's electrostatic field is shown to be largely determined by thunderstorm activity over land masses. An estimate is made of the number of lightning discharges over the globe and of the energy dissipated in the world's thunderstorms and of the area involved in its generation. R.H.Golde

LAMPS . ILLUMINATION

621.327.534 : 621.382.3

4129 THE APPLICATION OF POWER TRANSISTORS TO THE OPERATION OF GAS-DISCHARGE LAMPS FROM D.C. SUPPLIES. I.F.Davies and D.Dunthorne.
Proc. Instn Elect. Engrs, Paper 3192U, publ. Jan., 1960 (Vol. 107A, 273-81, 281-3, June, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 219 of 1960.

621.327.534.15

4130 HEAT IN FLUORESCENT LIGHTING FITTINGS. T.Hehenkamp.
Elect. Times, Vol. 137, 633-7 (April 21, 1960).

The relationship between lamp temperature and luminous and electrical characteristics is considered. The effect of temperature on the life of lamps, chokes, transformers and capacitors is noted. Factors governing the dissipation of heat from the ballasts and lamps are discussed, illustrations being given from practical examples. C.E.Williams

628.971

4131 A SURVEY OF STREET LIGHTING AND ITS FUTURE. W.R.Stevens and H.M.Ferguson.
Proc. Instn Elect. Engrs, Paper 3260 U, publ. May, 1960, 9 pp. To be republished in Vol. 108A (1961).

The accepted principles of street lighting are reviewed in conjunction with the requirements of the British Standard Code of Practice for Street Lighting. British and overseas techniques and standards are compared, and some important recent experimental work and installations are described. The factors are used to assess the desirable trend of street lighting in the future.

ELECTROCHEMISTRY

621.351

4132 FUEL CELLS. H.A.Liebhafsky and L.W.Niedrach.
J. Franklin Inst., Vol. 269, No. 4, 257-67 (April, 1960).

A general discussion of fuel cells which points out the great current interest in them and outlines the requirements they must meet. The status of representative fuel cells for special applications is indicated, and the ion-exchange membrane cell is discussed.

621.355.2

4133 ONE HUNDRED YEARS OF PROGRESS IN THE LEAD-ACID BATTERY INDUSTRY. G.Génin.
Bull. Soc. Franc. Elect. (Ser. 8), Vol. 1, 24-30 (Jan., 1960). In French.

Reviews the progress made in the design and performance of lead-acid batteries since their demonstration by Gaston Plante in 1860. This development is considered under three heads: (a) stationary batteries which still employ highly developed versions of Plante's plates but whose weight and volume have been reduced by half and lives of 20/25 years are common; (b) traction types, the early varieties being developed specifically for traction duties and quoted as yielding between 10 and 20 Wh/kg., with a life of 1-2 years, while modern versions yield up to 49 Wh/kg and have lives of 4/5 years; (c) starter types of which the modern varieties have a high-rate discharge performance many times better than that of the early pasted-plate designs. They have more than kept pace with the increasing demands of motor-car electrical equipment without the need for big increases in weight or volume. D.R.Way

621.355.8

4134 SEALED NICKEL–CADMIUM ACCUMULATORS. K.Dehmelt.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 1, 7-9 (Jan. 11, 1960). In German.

Describes the operation of normal unsealed Ni–Cd batteries and leads to an understanding of the operation of sealed types. Changes introduced to prevent undue pressure rise due to over-charging are discussed. W.A.Walker

621.357.8

4135 CONTRIBUTION TO THE PREPARATION OF FINE WIRES BY ELECTROLYTIC REDUCING. J.Solé.
Rev. gen. Elect., Vol. 69, No. 1, 37-55 (Jan., 1960). In French.

Reviews the known electrolytic polishing methods for producing fine wires and tapes. The author goes on to describe a new method involving a minimum mechanical strain on wires passing vertically through a novel electropolishing cell which revolves around the wire. The depth of the cell is important in producing an equipotential surface on the small section of wire being polished to produce a uniform round wire. Wires of 200μ diameter can be reduced to 15μ or less by passing to and fro through the cell. A novel washing system (the hydraulics of which are calculated) is installed on the wire each side of the polishing cell. The wire is checked by direct microscopic measurement. An electromagnetic method for the control of ferromagnetic wires in the process is fully described and checked on nickel and mumetal wires. W.A.Walker

ELECTRIC HEATING

621.362

4136 OPTIMUM REFLECTOR–ABSORBER GEOMETRY FOR A SOLAR GENERATOR. R.W.Stineman.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 332-7(1959) = Applic. and Industr. No. 45 (Nov., 1959).

The efficiency of a solar generator consisting of parabolic cylindrical reflector and variously shaped absorber-convertor set at a focus of the reflector is discussed from the point of view of the several parameters involved. Absorbers having plane, or circular configurations (concave or convex), are considered, and details of the method of analysis are given in a mathematical appendix. In all the cases investigated, the use of a selectively absorbing surface resulted in higher efficiency than obtained with a black surface. For each absorber shape there is shown to be an optimum ratio of reflector diameter to focal length which results in maximum efficiency, but in most practical cases the absorber shape is not of major significance. Another conclusion drawn is that the absorber temperature range that can be attained with reasonably high collection efficiency depends on the accuracy of manufacture and alignment of the reflector, and temperatures as high as 1500° F are mentioned as requiring relatively high precision. See also Abstr. 2220 of 1960. W.J.Mitchell

621.365 : 621-52

USE OF MODERN MEASURING AND CONTROL EQUIPMENT IN THE IRON AND STEEL INDUSTRY. See Abstr. 4540

621.365.4

4137 RESEARCH ON FLOOR WARMING. M.V.Griffith.
Elect. Times, Vol. 137, 281-4 (Feb. 25, 1960).

A short history, commencing with war-time air-raid shelter heating. The Medical Research Council put forward various points for experiment and the E.R.A. laboratories include a room specially adapted to floor-heating tests. No actual test figures are given but it is stated that the results are favourable. E.H.W.Banner

ELECTRIC WAVES AND OSCILLATIONS

LINES . NETWORKS . FILTERS

621.372 : 538.56 : 534.2 : 532.5

4138 SURFACE WAVE EXCITATION AND PROPAGATION. J.B.Keller and F.C.Karal, Jr.

J. appl. Phys., Vol. 31, No. 6, 1039-46 (June, 1960).

A geometrical theory is developed for the analysis of surface-wave excitation and propagation. The surfaces along which the surface waves propagate may be either curved or flat, and may have either constant or variable properties. The theory is based on the concept of a complex or imaginary ray. The excitation coefficient which enters the theory is determined from the solution of a canonical problem — that of a line source over an impedance plane. Then the theory is applied to the surface wave excited by a line source, on a wedge with variable surface impedance. The result agrees precisely with the asymptotic form of the exact solution. Another application is made to the surface wave excited on a cylinder by a line source. The result also agrees with the exact solution.

621.372

4139 SURFACE WAVES: A PROPOSED DEFINITION. H.E.M.Barlow.

Proc. Instn Elect. Engrs, Vol. 107B, 240 (May, 1960).

Defines a surface wave as one that propagates along an interface between two different media without radiation, such radiation being construed to mean energy converted from the surface-wave field to some other form.

621.372

4140 PERIODIC AND GUIDING STRUCTURES AT MICROWAVE FREQUENCIES. A.F.Harvey.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 30-61 (Jan., 1960).

Reviews the properties of periodic and guiding structures for the operation of components, aerials, electron tubes and low-noise amplifiers. An account is first given of dispersive propagation in periodic-loaded lines, showing how the frequency characteristic breaks into pass and stop bands. The formation of forward- and backward-space harmonics and the effect of systematic modification of loading are examined. A description is then given of the various types of surface-wave structures including dielectric rods, dielectric-clad metals, and corrugated surfaces, as well as surface wave instruments and circuits. Practical slow-wave structures such as ladder lines, coupled cavities and helices are finally treated. A bibliography of 293 items is given.

621.372.2

4141 COMPLEMENTARITY IN THE STUDY OF TRANSMISSION LINES. G.H.Owyang and R.King.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 172-81 (March, 1960).

The principle of complementarity is applied to the slot transmission line. The properties of a dual circuit are investigated. The pairs of several possible duals for a given configuration are correlated and new quantities are defined for use with different types of circuits. A complete parallelism between the two-wire line and the two-slot line is established for ideal cases and is extended by approximation to include practical cases. Measurements were made with a two-slot transmission line and its associated probing system. The method of testing the line for balance is discussed. The transverse distribution of the longitudinal current and the attenuation constant were measured. The analogy between the steady-state field in a conducting medium and the electrostatic field in a dielectric is investigated. The expressions for the constants of a two-slot line are given in a form that permits a ready evaluation from experimental data obtained with the electrolytic tank. The measured results are compared with theoretical values.

621.372.2

4142 A STUDY OF MULTIELEMENT TRANSMISSION LINES. H.Kogo.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 136-42 (March, 1960).

A solution to the general equations which relate the voltage difference between the lines and the mesh current is proposed. Under particular conditions, it is shown that only a single type of propagating mode exists. In this case, the solution was obtained by the so called "decomposition method", i.e., assuming several virtual two element transmission lines in lieu of the existing multielement transmission line. The problem was solved by means of the resolved superposed virtual lines taking into account the existing boundary condition.

621.372.2

4143 ENGINEERING CALCULATION OF CHEBYSHEV STEPPED TRANSITIONS. A.L.Fel'dshtein and L.R.Yavich.

Radiotekhnika, Vol. 15, No. 1, 3-15 (Jan., 1960). In Russian.

The behaviour and optimal design of stepped transmission lines are considered. In such lines the length of individual sections is assumed to be the same, but their wave impedance varies. Tables of parameter values for 2, 3 and 4 sections are given. Examples of calculations are shown. T.Horrocks

621.372.2

4144 BOUNDARY CONDITIONS AND OHMIC LOSSES IN CONDUCTING WEDGES. R.M.Chisholm.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 189-98 (March, 1960).

Deals with the boundary conditions required to calculate the ohmic losses occurring in metallic wedges under the influence of electromagnetic waves which are sinusoidal in time. The validity of the surface impedance condition used in calculating waveguide wall losses is examined carefully, and a "modified" surface impedance condition, which can be applied to wedge problems in which the perfectly conducting solution is known, is developed. A simple waveguide having a circular cross-section, a sector of which is occupied by a metal wedge, is used as an example. The tangential magnetic field variations along the surface of the wedge are shown graphically, demonstrating, near the tip of the wedge, a large deviation from the tagential magnetic field of the perfectly conducting solution.

621.372.413

4145 THEORY OF FORCED OSCILLATIONS IN MICROWAVE CAVITIES AND THE 2n-POLE EQUIVALENT CIRCUIT OF A CAVITY. H.J.Butterweck.

Arch. elekt. Übertragung, Vol. 14, No. 3, 101-14 (March, 1960). In German.

A microwave cavity is analysed and its equivalent n-port circuit is derived. The effect of coupling elements, losses in the cavity walls, as well as multimoding are considered. A.E.Karbowiak

621.372.413

4146 TEMPERATURE COMPENSATION OF COAXIAL CAVITIES. J.R.Cogdell, A.P.Deam and A.W.Straiton.

I.R.E. Trans Microwave theory and Tech., Vol. MTT-8, No. 2, 151-5 (March, 1960).

Describes a technique for temperature compensation of coaxial cavities by controlling the capacitance between the end of the centre conductor and an end plate across the outer conductor. A formula is derived for this capacitance which is verified experimentally. Supplemental design data are also obtained experimentally.

621.372.413

4147 METREWAVE CAVITIES WHICH TUNE AS LUMPED CONSTANT CIRCUITS. A.Soulard and C.Brot.

Rev. gen. Elect., Vol. 68, No. 11, 634-40 (Nov., 1959). In French.

Describes cavities which give straight-line capacitance and straight-line inductance variation. This is achieved by making parts of the cavity of re-entrant shape. A.H.W.Beck

621.372.413 : 621.396.662.4

REFERENCE CAVITIES FOR AUTOMATIC FREQUENCY CONTROL. See Abstr. 3749

621.372.414

4148 U.H.F. RESONATOR WITH LINEAR TUNING. B.H.Wadia and R.L.Sardn.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 66-72 (Jan., 1959).

A novel method of tuning a transmission-line type resonator is

described. The first-order theory of such a resonator is derived and presented in the form of design curves which indicate an extremely good tuning linearity. Experiments with a resonator designed on this principle agree with theory.

621.372.434

4149 A RESONANT COAXIAL-STUB AS AN AUTOMATIC EQUALIZER. G.V.Rao.
I.R.E. Trans Broadcasting, Vol. BC-6, No. 1, 1-11 (March, 1960).

Describes a novel application of a resonant coaxial-stub which is very short in comparison with the shorter wavelengths in the video spectrum. The stub provides automatic equalization at the input of a video circuit which presents a changing capacitance from time to time as a result of the incidence of additional video loops with appreciable input-capacity. The coaxial-stub has some interesting applications in video work; (1) as an automatic equalizer in colour and monochrome video switching systems; (2) for high-frequency equalization of the video distribution cables used in television studios; and (3) as an input high-frequency matching device in video distribution amplifier systems.

621.372.5

4150 GENERAL PRINCIPLES OF NETWORK ANALYSIS USING CONNECTION MATRICES. H.Edelmann.
Arch. Elektrotech. (Berlin), Vol. 44, No. 7, 419-40 (1959). In German.

The connection matrices enable the topological characteristics of a network to be studied. The matrices are invariant with respect to quantitative changes in the element values of the network. The theory is explained and an extensive list of references included.

V.G.Welsby

621.372.5

4151 CALCULATION OF RETURN DIFFERENCE AND SENSITIVITY IN ACTIVE LINEAR QUADRIPOLES.
H.Mertens.
Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 72, No. 12, 767-86 (Dec., 1959). In French.

The relationships between the properties of the network and its various matrices are discussed. In particular it is shown how the presence of negative or positive feedback within the network can be inferred from measurements of currents and voltages at its terminals.

V.G.Welsby

621.372.5 : 621.382.3

4152 AN APPLICATION OF MATRIX METHODS TO THE DETERMINATION OF LOW- AND HIGH-FREQUENCY EQUIVALENT CIRCUITS OF TRANSISTORS WITH GROUNDED BASE AND GROUNDED EMITTER R.Mezencev.
C.R. Acad. Sci. (Paris), Vol. 250, No. 13, 2338-40 (March 28, 1960). In French.

The necessary transformations of the impedance matrix are first given and then applied to the low-frequency simple T equivalent circuit and to the latter circuit modified by the addition of emitter and collector capacitances.

F.F.Roberts

621.372.5 : 621.318.42

4153 THE DESIGN OF A PARALLEL CIRCUIT WITH AN IRON-CORED COIL. V.Glukhov and E.Yakubaitis.
Latv. PSR Zinat. Akad. Vestis, No. 10(147), 59-64 (1959). In Russian.

Starts from the fact that a complicated circuit made up of real linear resistances and an iron-cored coil can be represented as a passive linear quadripole with a given voltage at the input and with the coil across the output. This latter circuit is shown to be reducible to a new voltage acting across a certain resistance in series with the coil (assuming uniform flux distribution and sinusoidal input voltage). The series circuit is worked out with the aid of the principle of similarities. A numerical example is included.

D.E.Brown

621.372.5

4154 A CONTRIBUTION TO THE STUDY OF THE EFFICIENCY OF POWER TRANSFER IN LINEAR QUADRIPOLES. M.C.Vanwormhoudt.
Rev. H.F., Vol. 4, No. 8, 178-82 (1959). In Dutch.

A geometrical method, using elementary geometry only, is introduced to deal with the efficiency of quadripoles. The diagrams are discussed as functions of the input impedance and Smith-transformed input impedance. It appears that the efficiency, as a function of the load impedance, can be shown. The method is extended to non-reciprocal quadripoles.

E.Maanders

621.372.5

4155 THE APPLICATION OF WAVE MATRICES FOR THE CALCULATION OF CROSS-SYMMETRICAL FOUR-POLES.
L.R.Yavich.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 341-4 (Feb., 1959). In Russian.

It is shown that the method of analysing four-pole networks using wave matrices previously described by the author (Radiotekhnika i Elektronika, Vol. 2, No. 7, 1957), may be substantially simplified if there is vertical symmetry. Two examples are worked out. [English summary: PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.].

R.C.Glass

621.372.542

4156 SPECIAL BAND-PASS HALF-SECTIONS. K.Stegemann.
Nachrichtentechnik, Vol. 9, No. 11, 502-5 (Nov., 1959). In German.

A method is developed for calculating quartz filters by the wave parameter theory. The basic half-section considered contains two series-connected parallel-tuned circuits in the series arm, and a crystal in the shunt arm. Design formulae and wave-impedance functions are derived for the above configuration. Formulae are given for the components of the half-section. The cases of a crystal filter with a coil-capacitor pole in the upper stop-range and in the lower stop-range are fully developed.

J.M.Silberstein

621.372.553 : 621.397.2

4157 A QUADRATURE NETWORK FOR GENERATING VESTIGIAL-SIDEBAND SIGNALS.
G.G.Gouriet and G.F.Newell.
Proc. Instn Elect. Engrs, Paper 3054 E, publ. Oct., 1959 (Vol. 107B, 253-60, 281-4).

Republication, with discussion, of the paper already abstracted as Abstr. 7248 of 1959.

621.372.6

4158 THE GAUSSIAN PRINCIPLE OF LEAST WORK AND THE POSSIBILITY OF ITS APPLICATION TO ELECTRICAL PROBLEMS. H.Teichmann.
Arch. Elektrotech. (Berlin), Vol. 44, No. 5, 275-8 (1959). In German.

The analogy between certain electrical and mechanical problems is pointed out and the suggestion made that some of the basic theory of analytical mechanics may be applicable to electrical circuits.

V.G.Welsby

621.372.6

4159 SOME CONSIDERATIONS IN THE SYNTHESIS OF RESISTIVE MULTIPOLES. G.Biorci and P.P.Civalleri.
(Atti) Accad. Sci. Torino I, Vol. 94, No. 2, 211-23 (1959-60). In Italian.

Gives the necessary and sufficient conditions for a conductance matrix of order n to be realized by a network with (n + 1) nodes. It is assumed that the non-diagonal elements of the matrix are either all negative or all positive.

V.G.Welsby

621.372.6

4160 THE DESIGN OF PURELY REACTIVE OCTOPOLES IN TERMS OF THEIR DISTRIBUTION MATRICES. R.Leroy.
Cables et Transm., Vol. 14, No. 1, 42-59 (Jan., 1960). In French.

The general theory is given and some examples included of the form in which networks of this type may be realized. These include various combinations of two differential transformers and a pair of filters.

V.G.Welsby

621.372.6

4161 SIGNAL FLOW-GRAPH ANALYSIS AND FEEDBACK THEORY. R.F.Hoskins.
Proc. Instn Elect. Engrs. Monogr. 388 E, publ. July, 1960, 8 pp. To be republished in Part C.

The solution of a system of simultaneous linear equations may be obtained by inspection of an associated system of nodes and connecting branches called a "signal flow-graph". This provides an alternative to conventional algebraic methods which is of particular interest in the case of network analysis, since the flow graph can be set up directly by inspection of the network without having to formulate the associated equations. In the paper the formal theory of flow-graph analysis is developed and applied to certain aspects of feedback theory, and it is shown that the classical results of Bode can be obtained and generalized relatively simply by this approach.

621.372.6 : 621-52

4162 RECURRENCE RELATIONS IN THE SOLUTION OF A CERTAIN CLASS OF NONLINEAR SYSTEMS. A.A.Wolf. Trans Amer. Inst. Elect. Engrs I, Vol. 78, 830-4 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A class of nonlinear systems is considered mathematically, for which it is possible to develop exact and unique mathematical solutions. These are systems describable by ordinary nonlinear differential equations of the form:

$$Z(D)x(t) + F(x,\dot{x},\ldots,x^{(m)},\ldots) = g(t)$$

where $Z(D)$ is a linear integro-differential operator; $F(x,\dot{x},\ldots x^{(m)},\ldots)$ is a nonlinear function of the response and its derivatives; and $g(t)$ is a forcing function. The nonlinear functions considered are confined to functions of x only, but the method is not so limited.

T.Horrocks

621.372.6

4163 CRITERIA AND TESTS FOR REALIZABILITY OF THE INDUCTANCE MATRIX. Y.Tokad and M.B.Reed. Trans Amer. Inst. Elect. Engrs I, Vol. 78, 924-6 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

Realizability can be tested by checking the signs of all the principal subdeterminants of the given matrix. The arithmetic involved may be extensive. A different test has therefore been suggested, based on the eigenvalues of the inductance matrix. An example is quoted. V.G.Welsby

621.372.6 : 621.317.34

ANALYSIS OF MICROWAVE MEASUREMENT TECHNIQUES BY MEANS OF SIGNAL FLOW GRAPHS. See Abstr. 4064

WAVEGUIDES

621.372.8

4164 MICROWAVES, THEIR HISTORY, PRESENT STATE AND FUTURE. R.Champeix. Acta Electronica, Vol. 4, No. 1, 7-17 (Jan., 1960). In French.

A review of valves, microwave systems and some forecasts of future developments. A.H.W.Beck

621.372.81

4165 WAVEGUIDE TECHNIQUES. O.Henke and G.Stricker. Frequenz, Vol. 14, No. 3, 94-104 (March, 1960). In German.

A discussion of various aspects of microwave engineering with particular reference to techniques and some illustration of applications. A.E.Karbowiak

621.372.822

4166 PARALLELOGRAM WAVEGUIDES. A.Ya.Yashkin. Radiotekhnika, Vol. 15, No. 1, 26-9 (Jan., 1960). In Russian.

A knowledge of the properties of these is important for calculating the manufacturing tolerances for rectangular waveguides and for possible applications as transmitting and matching elements. The characteristic system of equations is deduced in Cartesian and cylindrical coordinates by transforming the cross-section to a stepped shape. The lowest critical H-type wave can thus by found for any parallelogram waveguide. Good agreement was found between calculated and experimental results. D.E.Brown

621.372.823 : 538.56

4167 PROPAGATION OF QUASI-CIRCULAR ELECTROMAGNETIC WAVES IN A WAVEGUIDE OF CROSS-LIKE CROSS-SECTION. V.M.Sedykh and A.F.Zorkin. Zh. tekh. Fiz., Vol. 30, No. 2, 159-64 (Feb., 1960). In Russian.

The field equations are used to obtain relations for the determination of critical frequencies of a quasi-circular electromagnetic wave, as well as a wave transformed from the E_{11} mode, in a circular guide. The propagation constant is calculated and plotted against frequency when such waves are transmitted in a waveguide of cross-like cross-section. J.K.Skwirzynski

621.372.823.1

4168 THE FIELD PATTERN OF THE eE_{01} WAVE IN ELLIPTICAL WAVEGUIDE. S.Smorgonskii. Radiotekhnika i Elektronika, Vol. 4, No. 2, 335-7 (Feb., 1959). In Russian.

It is shown that the field patterns of the eE_{01} and eH_{01} waves in elliptical waveguide as given by Chu (1938) and widely quoted, are incorrect. [English summary: PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.372.823.2

4169 THE PASSAGE OF A H_{01}-WAVE THROUGH A CURVED HELICAL WAVEGUIDE. N.P.Kerzhentseva. Radiotekhnika i Elektronika, Vol. 4, No. 2, 337-41 (Feb., 1959). In Russian.

Expressions are derived for the coupling coefficients of the H_{01} wave for parasitic waves in a curved helical waveguide consisting of a metal helix surrounded by a dielectric envelope. Such a waveguide eliminates degeneracy between H_{01} and E_{11} waves. [English summary: PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.372.823.2 : 538.56

4170 INVESTIGATION OF A HELIX-ANISOTROPIC DIELECTRIC AND HELIX-RIBBED STRUCTURE SLOW-WAVE SYSTEMS. I. V.P.Shestopalov and V.A.Slyusarskii. Zh. tekh. Fiz., Vol. 29, No. 11, 1317-29 (Nov., 1959). In Russian. English translation in: Soviet Physics — Technical Physics (New York), Vol. 4, No. 11, 1212-22 (May, 1960).

The dispersion equations are obtained for a helix located in an anisotropic dielectric; the distribution of the power flow is also determined. The limiting case for the transition from a helix-anisotropic dielectric slow-wave system to a helix-ribbed structure slow-wave system is considered. The possibility of using a helix with a periodic variation in a travelling-wave tube is also considered.

621.372.824

4171 CURRENT DISPLACEMENT IN TUBES AND COAXIAL CONDUCTORS. W.Held and K.Wenzel. Arch. Elektrotech. (Berlin), Vol. 44, No. 5, 306-317 (1959). In German.

Applies Maxwell's equations in the usual way to the field between two coaxial tubes, assuming stationary sine wave a.c., and obtains an exact expression for the current displacement. Numerous graphs and tables enable the a.c. impedances and depths of penetration to be easily computed numerically throughout the frequency range (not just for very low or very high frequencies). Several worked examples are included. D.E.Brown

621.372.824

4172 BROAD-BAND COAXIAL CHOKED COUPLING DESIGN. H.E.King. I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 132-5 (March, 1960).

Equations and curves are presented to predict the frequency bandwidth of coaxial choke couplings in terms of the choke parameters. Choke couplings discussed are those applicable to rotary joints and d.c. isolation units.

621.372.825

4173 A SIMPLE METHOD FOR PREDICTING THE CHARACTERISTICS OF TAPE STRUCTURES. J.Allison. Proc. Instn Elect. Engrs, Paper 3229 E, publ. May, 1960 (Vol. 107B, 295-300).

A method is described for calculating the dispersion characteristics and coupling impedance of a Karp-type slow-wave structure. The structure is regarded as a ridge waveguide, periodically loaded with short-circuited stub lines. The analysis is simple and lends itself to the speedy assessment of the performance of a particular circuit. Measurements on 8 and 4 mm experimental backward-wave oscillators are described and are shown to verify the usefulness of the approximate theory. These results are also compared with those obtained by field-theory analyses.

621.372.829

4174 THE BEHAVIOUR OF HELICES AS DELAY LINES, IN PARTICULAR THE LOSSES AND PHENOMENA DUE TO ROTATING FIELDS. G.Piefke.
Arch. elekt. Übertragung, Vol. 14, No. 7, 15-25 (Jan., 1960). In German.

The finite conductor-thickness is taken into account and an arbitrary outer medium is assumed. For fixed frequency, pitch and mean radius there is an optimum conductor diameter for minimum attenuation. The rotating fields behave differently according to whether they rotate with or against the rotation of the conductor and small attentuation results when the rotations are in the same sense. The helix can thus be made to act as an isolator. A.H.W.Beck

621.372.829 : 538.56

4175 DISPERSIVE PROPERTIES OF A COAXIAL SPIRAL LINE PLACED IN A MAGNETO-DIELECTRIC MEDIUM. V.P.Shestopalov and L.I.Spol'nik.
Zh. tekh. Fiz., Vol. 30, No. 1, 3-14 (Jan., 1960). In Russian.

Dispersion curves are computed for both slow and fast waves which can be propagated in a coaxial spiral line placed in such a medium. The forbidden regions of propagation are established and the results are fully illustrated. J.K.Skwirzynski

621.372.83

4176 DESIGN OF MODE TRANSDUCERS. L.Solymar and C.C.Eaglesfield.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 61-5 (Dec., 1959).

The propagation of the electromagnetic wave in a gradual transducer is discussed. It is shown that the incident mode and the geometry of the transducer determine the outgoing mode. Inverting this theorem, a method is suggested for the design of the transducer's surface for cases in which the desired modes in the uniform waveguides are given. The application of the method is illustrated in three examples.

621.372.831.4

4177 EQUIVALENT CIRCUITS FOR SMALL SYMMETRICAL LONGITUDINAL APERTURES AND OBSTACLES. A.A.Oliner.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 72-80 (Jan., 1960).

Formulae based on small-aperture and small-obstacle theory are presented for the determination of equivalent circuits for symmetrical longitudinal apertures and obstacles. These formulae are then applied to several examples of practical interest, including aperture discontinuities in trough waveguide and an obstacle array of interest to anisotropic radomes.

621.372.831.4

4178 RESONANT MODES IN WAVEGUIDE WINDOWS. M.P.Forrer and E.T.Jaynes.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 147-50 (March, 1960).

Analysis and experimental verification of a class of resonant fields, called ghost-modes, occurring in waveguide dielectric windows is presented. Numerical solutions for a simple geometry are given through universal curves. Knowledge about ghost-modes has importance to designers of high-power windows. It also leads to a measuring technique for dielectric constants through a frequency measurement.

621.372.832.43

4179 THE MICROWAVE CIRCULATOR. E.Privit and W.Stösser.
Frequenz, Vol. 14, No. 3, 77-84 (March, 1960). In German.

A brief survey of the subject is followed by a theoretical analysis based on the scattering matrix formulation. The theory is used to calculate permissible tolerances in the individual component parts involved. Some experimental results obtained for phase-shift circulators are presented. In the case of an X-band instrument, a backward loss > 25 dB and a forward loss < 0.2 dB was maintained over a 12% bandwidth. E.A.Ash

621.372.832.43

4180 COAXIAL-LINE DIRECTIONAL COUPLERS. I.Bucci.
Alta Frequenza, Vol. 28, No. 3-4, 260-76 (June-Aug., 1959). In Italian.

An ideal coupler is considered as an 8-pole, and coupling factor and directivity are defined. The theory shows that perfect directivity requires a series impedance common to the lines forming the 8-pole and a shunt impedance between them of opposite sign. In a practical system the two inner conductors are brought close together for a certain length, with a common outer. This provides mutual inductance and shunt capacitance. It is shown that $M/C = Zo\acute{Z}o$, where Zo and Ź are the characteristic impedances of the primary line (generator to load) and the secondary line respectively. Applications include power monitoring, the measurement of reflection coefficents, and the application of local oscillator power to the frequency-changer in radio receivers without radiation. An experimental coupler for 45-95Mc/s is illustrated and curves of the results are given. W.G.Stripp

621.372.832.6

4181 THE MAGIC-T. W.Stösser.
Frequenz, Vol. 14, No. 1, 17-19 (Jan., 1960). In German.

Properties of a T-junction and a hybrid-T are discussed in terms of the elements of the scattering matrix. An analysis of conditions of match is carried out and the necessary relations between matrix elements derived. A.E.Karbowiak

621.372.832.6

4182 AN N-WAY HYBRID POWER DIVIDER. E.J.Wilkinson.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 116-18 (Jan., 1960).

A circularly symmetric power divider is described which splits a signal into n equiphase equiamplitude parts where n can be odd or even. The power divider provides isolation between output terminals and approximately matched terminal impedances over about a 20% band. A theory of operation is given which yields the necessary design parameters, and an experimental model is described which has a minimum isolation of –27 dB between output terminals, an output v.s.w.r. of 1.6, and an input v.s.w.r. of 1.2.

621.372.832.6

4183 WIDE-BAND STRIP-LINE MAGIC-T. E.M.T.Jones.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 160-8 (March, 1960).

Presents theoretical performance calculations of a novel form of wide-band strip-line magic-T that uses two dual strip-line band-pass filters. When all four ports are terminated in the same impedance, the v.s.w.r. at each port is less than 1.47 over a 2 : 1 frequency band, while the isolation between opposite ports is greater than 20 dB over this band.

621.372.832.8

4184 A HIGH-POWER S-BAND FERRITE CIRCULATOR. D.Masse.
Onde elect., Vol 40, 150-4 (Feb., 1960). In French.

Outlines the design and summarizes the performance: over 2.6-3.1 kMc/s the transmission loss never exceeds 0.8 dB, the isolation loss is never less than 20 dB, and the s.w.r. never greater than 1.15 up to peak powers of 5 MW with mean powers of 10 kW. F.F Roberts

621.372.833

4185 A CIRCULAR-POLARIZATION DUPLEXER FOR MILLIMETER WAVES. R.G.Fellers.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 934-7 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

The millimetre-wave duplexer described is suitable for radar application and consists of two suitable oriented gratings, A and B, placed in the path of a vertically-polarized transmitter beam. The beam is transmitted without loss through both gratings and emerges from B as a circularly polarized wave. Upon reflection from the target the sense of the circular polarization is reversed and after passing back through B the wave becomes horizontally polarized and suffers complete reflection by A into the receiving horn. This duplexer is claimed to produce far less loss that the 6 dB loss inherent in the magic-T or hybrid-junction duplexers. H.L.Nattrass

621.372.837.2

4186 A NEW CONCEPT IN MICROWAVE GAS SWITCHING ELEMENTS. R.S.Braden.
I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 54-9 (Jan., 1960).

The problem of achieving simultaneously a short recovery time and a low arc loss has been eliminated by the development of the device described. The design objective was to produce a self-contained TR window for operation at very high powers. The arc loss developed by conventional tube design at these high power levels would be sufficient to melt any known window material. The design of this device is such that the ionizable gas blanket takes the form of a thin-walled cylinder suspended in the iris in a dielectric cylinder. This configuration presents a smaller volume of gas with a reduced cross-section and a much shorter diffusion length. These changes result in lower leakage power, faster recovery time, and reduced arc loss. As finally developed, the window does not involve glass-to-metal or ceramic-to-metal seals. The problem of metal sputtering or outgassing is therefore eliminated. By a unique spring pressure support, the problem of strain developed by differences of thermal coefficients of expansion is eliminated. The open-ended design of the cylinder provides excellent facilities for cooling the window.

621.372.852.21

4187 MEASUREMENT OF ELECTRIC-FIELD DISTRIBUTIONS IN A WAVEGUIDE CONTAINING A DIELECTRIC SLAB. K.W.H.Foulds and P.M.J.C. da S.Sampaio.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1663-4 (Sept., 1959).

The anomalous values for the electric-field distribution reported by Strauss [I.R.E. WESCON Convention Record, Vol. 2, Pt I, 135-46 (1958)] are discussed. If, when measuring the field in the dielectric-filled part of the waveguide, a dielectric sleeve is used to cover the probe, then the measured values agree well with those calculated. The importance of returning the probe in order to allow for changes in capacitative loading as it moves in the waveguide is stressed.
W.T.Blackband

621.372.852.22

4188 ON THE THEORY OF THE FERRITE RESONANCE ISOLATOR. E Schlömann.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 199-206 (March, 1960).

The attenuation constants for both directions of propagation in a rectangular waveguide loaded with a small slab of ferrite are calculated by means of perturbation theory. The maximum attainable ratio of reverse to forward attenuation is found to be inversely proportional to the square of the bandwidth, with a constant of proportionality that is dependent on the shape of the ferrite slab and the proximity of cut-off. The figure of merit is largest for the case of a thin ferrite slab magnetized perpendicular to the plane of the slab. It is shown that a significant increase in the figure of merit can be obtained by proper use of the anisotropy of grain-oriented materials or single crystals.

621.372.852.3 : 538.56

4189 MULTIMODE PROPAGATION IN GYROMAGNETIC RODS AND ITS APPLICATION TO TRAVELING-WAVE DEVICES. J.E.Tompkins, F.Reggia and L.Joseph.
J. appl. Phys., Suppl. to Vol. 31, No. 5, 176S-177S (May, 1960).

Summarizes the results of exact calculations of the propagation constants in longitudinally-magnetized gyromagnetic rods. Specifically described are: (a) the mode behaviour for a lossless rod in cylindrical waveguide as a function of rod diameter in the low-field region; (b) a comparison of the calculations with experimental results obtained with a magnetized ferrite rod in rectangular waveguide showing probable negative circular polarization of the field when concentrated within the rod; (c) a brief summary of the calculations of the propagation in rods at high d.c.fields; and (d) a new broadband microwave absorption switch having constant electrical characteristics over a bandwidth of 3000 Mc/s at X band.

621.372.852.5

4190 STEPPED TRANSFORMERS FOR PARTIALLY FILLED TRANSMISSION LINES. D.J.Sullivan and D.A.Parkes.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 212-17 (March, 1960).

Presents a generalized outline for determining the approximate effective guide wavelength and characteristic impedance of two types of (dielectric-loaded) partially filled transmission line. The results are used to determine the geometries required for the design of optimum stepped transmission line transformers. The stepped transitions are designed to yield a Chebyshev-type response for any given bandwidth. The measured results for stepped transitions in partially filled coaxial line and partially filled double-ridge waveguide are presented The data are found to approximate the theory closely.

621.372.852.6

4191 A GENERAL THEOREM ON AN OPTIMUM STEPPED IMPEDANCE TRANSFORMER. H.J.Riblet.
I.R.E.Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 169-70 (March, 1960).

With the assistance of a mathematical theorem demonstrated by Eaton (see following abstract), it is shown rigorously, in the limit of small impedance transformation, that the familiar binomial impedance transformer, consisting of equal quarter-wave steps, is the shortest, monotonic, maximally flat, stepped, transmission-line transformer having steps commensurate in length with the midband guide-wavelength, and coincident zeros at the midband frequency. It is shown how this theorem places very severe limitations on any effort to improve on the performance of a quarter-wave transformer by increasing the number of its impedance steps without a corresponding increase in its length.

621.372.852.6

4192 MINIMAL POSITIVE POLYNOMIALS. J.E.Eaton.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 171 (March, 1960).

A proof is given of a purely mathematical theorem on the polynomial of lowest degree with positive coefficients having a prescribed root of unity as a multiple root. In the preceding abstract this theorem is applied to optimum impedance-transformer design.

OSCILLATORS . PULSE GENERATORS

621.373

4193 THE EFFECT OF AN E.M.F. WITH PERIODICALLY VARYING PARAMETERS ON AN OSCILLATING SYSTEM. N.N.Lunacharskii.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 286-94 (Feb., 1959). In Russian.

Phase variation due to the action of an e.m.f. of periodically varying amplitude and frequency is considered. An analysis of the locking conditions and non-stationary processes is given for the general case and also a detailed consideration of the locking conditions when the e.m.f. consists of a sequence of coherent pulses. [English summary: PB141106 T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.].
R.C.Glass

621.373.1

4194 DESIGN STUDIES FOR A RUBIDIUM GAS CELL FREQUENCY STANDARD. J.M.Andres, D.J.Farmer and G.T.Inouye.
I.R.E. Trans Military Electronics, Vol. MIL-3, No. 4, 178-83 (Oct., 1959).

A description is given of several studies undertaken in the design of a small, gas-cell stabilized atomic frequency standard making use if the field-independent hyperfine resonance of Rb^{87} at 6834 Mc/s. Rb light from a vapour lamp is used to enhance the population differences between the atomic levels involved in the resonance and also to provide a means of detecting microwave resonance. One of the studies described is concerned with the generation of requisite microwave energy at resonant frequency, another with the choice of an optimum length for the gas cell, and the last with the optimization of parameters for the modulation process used.

621.373.4

4195 ON THE RESONANT RESISTANCE OF OSCILLATING CIRCUITS WITH VALVES AT VERY HIGH FREQUENCIES. A.Kraus and R.Uhlitzsch
Rohde u. Schwarz Mitt., No. 11, 215-18 (1958). In German.

Experimental measurements in the frequency range 400-2500 Mc/s made on the following types of tuner are described: (a) drum tuner; (b) coaxial line; (c) Line of variable length achieved by rotating a bank of line segments of different lengths; (d) cavity resonator.
A.H.W.Beck

621.373.421

4196 PRECISION OSCILLATOR WITH INCREMENTAL TUNING. J.H.Reyner.
Electronics, Vol. 33, No. 16, 76, 78 (April 15, 1960).

The Wien bridge decade oscillator described uses a variable phase-shift RC coupling in which one variable capacitor is ganged to the main bridge tuning dial, and another in parallel with it gives constant increments of frequency over the 10 : 1 range of the main dial. The frequency stability is better than 0.1%. W.G.Stripp

621.373.421.1

4197 THE POSSIBILITY OF THE FURTHER GENERALIZATION OF THE QUASI-LINEAR THEORY OF SINGLE-STAGE LC-OSCILLATORS. P.G.Korolev.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 262-71 (Feb., 1959). In Russian.

A single-circuit LC-oscillator with an external harmonic e.m.f. introduced into the grid circuit is considered. An attempt is made to generalize the various results obtained in the quasi-linear theory of single-circuit LC-oscillators and to develop further the study of the phenomenon of synchronization. A general expression is obtained for the complex amplitude of the first harmonic of the oscillator anode current valid for arbitrary form of the tube characteristics and arbitrary values of external e.m.f., synchronous or asynchronous. It is shown that synchronous oscillation is the most general form of operation of the LC-oscillator including in itself both self-oscillatory and asynchronous effects. The expressions obtained also enable a single procedure for all cases of operation to be obtained and enable a qualitative investigation of the shortened differential equation of the synchronized oscillator to be carried out. [English summary: PB 141106 T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.373.421.1

4198 THE SYNCHRONIZATION OF OSCILLATORS AT COMBINATION FREQUENCIES FOR WIDEBAND FREQUENCY STABILIZATION. G.M.Utkin.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 272-85 (Feb., 1959). In Russian.

A system of three coupled oscillators, two of which have tuned circuits with resonant frequencies the sum of which is close to the resonant frequency of the tuned circuit of the third oscillator (or a multiple of it), is examined. Under certain conditions the instability of the two generated frequencies is defined by the difference in instability of the resonant frequencies of the oscillator and may be made very small. The effect of supply voltage on oscillator frequency is also found to be much reduced. As these properties are maintained over a band of frequencies, the system is suitable for wideband frequency stabilization. Possible forms of such systems are considered. [English summary: PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.373.421.13

4199 SHORT-TIME STABILITY OF A QUARTZ-CRYSTAL OSCILLATOR AS MEASURED WITH AN AMMONIA MASER. A.H.Morgan and J.A.Barnes.
Proc. Inst. Radio Engrs, Vol. 47, No. 10, 1782 (Oct., 1959).

It is found that when the quartz oscillator crystal is immersed in liquid helium the short term stability is improved but a relatively long term drift occurs. By controlling the pressure of the helium gas above the liquid the long term drift can be reduced at the expense of short term stability. The oscillator under test worked at 5 Mc/s, and was checked via a multiplier chain, against the ammonia maser (23 870 Mc/s). Under optimum operating conditions a drift of less than two parts in 10^{11} was observed. G.D.Sims

621.373.421.13

4200 IMPROVED HIGH-PRECISION QUARTZ OSCILLATORS USING PARALLEL FIELD EXCITATION. R.Bechmann.
Proc. Inst. Radio Engrs, Vol. 48, No. 3, 387-8 (March, 1960).

Piezo-electric oscillators are normally excited by fields perpendicular to the plate using two electrodes covering the major surfaces. With an AT or BT cut crystal the normal thickness shear mode can be excited by a field parallel to the plate using electrodes covering only part of both major surfaces and forming a parallel gap across which the exciting field is maintained. The oscillating system has a higher Q and the equivalent circuit parameters can be controlled by the width of this gap. It is claimed that these crystals are particularly suitable for applications requiring high-precision frequency-control. A.P.C.Thiele

621.373.43

4201 A FOUR-RECTIFIER BRIDGE AS A GENERATOR OF RECTANGULAR SIGNALS. R.Dehors and G.Séguier.
C.R. Acad. Sci. (Paris), Vol. 250, No. 13, 2341-3 (March 28, 1960). In French

The circuit has a source of d.c. in series with the load across the bridge. The resultant currents are analysed and expressions for the output voltage waveforms in terms of circuit and diode resistances are derived. W.G.Stripp

621.373.432

4202 NOISE GENERATORS FOR CENTIMETRE WAVE-LENGTHS. R.Saier.
Frequenz, Vol. 14, No. 2, 68-70 (Feb., 1960). In German.

After reviewing the properties of gas-discharge tubes as noise sources, details of two generators are given, for 3.3-4.9 Gc/s and 5.85-8.2 Gc/s. Both use a discharge tube mounted at an angle in the broad face of a length of waveguide with a built-in attenuator calibrated directly in noise figure. The maximum noise output is 16dB. W.G.Stripp

621.373.44

4203 SOME RECENT IMPROVEMENTS IN LOW POWER PULSE GENERATORS. R.P.F.Lauder and P.A.James.
J. Brit. Instn Radio Engrs, Vol. 20, No. 4, 253-63 (April, 1960).

Three low-power pulse generators used as sub-modulators driving a 5C22 type of thyratron are described. These may be triggered by an external sine wave or pulse source, or may free-run with a high degree of temperature stability. All circuits use miniature thyratrons. A circuit showing a method of overcoming the limitation of maximum duty ratio of the 2D21 is also presented.

621.373.44

4204 A LOW-LEVEL PULSE-HEIGHT STANDARD. T.E.Lommasson and W.W.Grannemann.
Proc. Inst. Radio Engrs, Vol. 48, No. 3, 361 (March, 1960).

Shows a circuit for producing calibrated low-level pulses in the range zero to 2 volts to accuracy of better than one-half of 1% of full range. Overshoot of the transistor on short pulses is avoided by use of a 2N 502 type, allowing generation of pulses down to 0.2 μsec. with rise and fall times of 0.08 μ secs. The d.c. collector voltage, measurable with a high-impedance differential voltmeter, is equal to the output pulse. W.J.Mitchell

621.373.52

4205 ULTRASONIC FREQUENCY POWER GENERATOR USING TRANSISTORS. Yin-Min Wei.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 1062-5 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

The use of transistors as high-current switches and their application to two- and four-arm bridge-type oscillating circuits is discussed. Details of various configurations to give output powers between 50 W and 1 kW are given. A 1 kW unit weighing 50 lb with a d.c. to a.c. power conversion efficiency of 85% has been constructed using silicon transistors rated at 20 A 300 V: it is claimed that this unit is ¼ the size of a comparable valve unit. A.P.C.Thiele

621.373.531.4

4206 VOLTAGE-CONTROLLED BOOTSTRAP GENERATOR. J.B.Payne, III.
Electronics, Vol. 33, No. 11, 177-8 (March 11, 1960).

A 3-transistor circuit produces a linear sweep of duration and amplitude proportional to a direct control voltage; a rectangular wave of the same duration is also generated. Linearity can be improved by adding a fourth transistor. W.G.Stripp

PULSE CIRCUITS . DIGITAL CIRCUITS SWITCHING CIRCUITS

621.374.32

4207 SWITCHING ALGEBRA — A NEW ELECTRONIC CALCULATING METHOD. F.Behringer.
Elektronik, Vol. 9, No. 2, 33-7 (Feb., 1960). In German.

621.374.32

4208 BASIC LOGICAL COMBINATION. E.K.Aschmoneit.
Elektronik, Vol. 9, No. 2, 39-41 (Feb., 1960). In German.

621.374.32 : 681.142

4209 BIBLIOGRAPHY OF FORIEGN LITERATURE ON SWITCHING SYSTEM THEORY AVAILABLE IN 1956.
Avtomat.i Telemekh., Vol. 19, No. 10, 992-6 (1958). In Russian.

621.374.32 : 621.318.57

4210 COMPARISON OF N-P-N TRANSISTORS AND N-P-N-P DEVICES AS TWENTY-AMPERE SWITCHES. H.W.Henkels and F.S.Stein.
I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 39-45 (Jan., 1960).

A series of silicon n-p-n transistors and three-terminal n-p-n-p switches have been developed, and their characteristics are compared with respect to high-current switching applications. At present, collector—emitter voltages of the transistors are generally lower than those of the switches, which may exceed 400 V. The n-p-n transistors are somewhat simpler to produce than the n-p-n-p structures. However, the ultimate current-handling capacity of the latter type of device is greater, because of the uniform current density. The saturation voltage drops at 20 A are comparable, being of the order 1-2 V. The switch has a distinct advantage in the turn-on speed, while the transistor has the equally important advantage that the base retains control for turn-off.

621.374.32

4211 THE REALIZATION OF SWITCHES FOR BOTH DIRECTIONS OF CURRENT FLOW USING JUNCTION TRANSISTORS. W.Hilberg.
Elektron. Rdsch., Vol. 13, No. 12, 438-40 (Dec., 1959). In German.

Although symmetrical transistors would be better, ordinary junction transistors can be used as reasonable approximations to ideal switches in circuits designed to handle both directions of current flow. Various circuits, basically of the bridge type using transistors and diodes, are given and their characteristics discussed. An experimental circuit, using OC 614's, switched 250 mA in each direction at 0.1 μs with a forward resistance of 3 Ω. About 15 V could be switched, though with silicon transistors this could have been higher, and the 'off' resistance was 5 to 10 MΩ.

G.A.Montgomerie

621.374.32 : 621.382.3

4212 THE TRANSISTOR AS A PASSIVE CIRCUIT ELEMENT. A.Darré.
Frequenz, Vol. 14, No. 1, 6-10 (Jan., 1960). In German.

A transistor may be used without an external source of power and then acts as a passive element of the circuit in which it occurs, such a device has several applications, for which circuits are given and the characteristics discussed. It can form a control for alternating current, logical AND and gate elements for either positive or negative signals, any of the possible logical elements having two inputs (the EXCLUSIVE OR is used as another example), and in various special logical circuits including some which will accept both positive and negative inputs.

G.A.Montgomerie

621.374.32

4213 ONE-CYCLE MAGNETIC SHIFT-REGISTER. A.Ya.Artyukhin and V.Z.Khanin.
Avtomat.i Telemekh., Vol. 19, No. 10, 977-87 (1958). In Russian.

An analysis of the operation of the simplest magnetic shift-register circuit, approximate design calculations and experimental data, including the use of one core per sign, are given. The influence of the length of the shift pulse on register operation is discussed.

621.374.32 : 681.142

PROCEEDINGS OF THE EASTERN JOINT COMPUTER CONFERENCE. See Abstr. 3849

621.374.32 : 621.318.12

4214 SOLVING NOISE PROBLEMS IN DIGITAL COMPUTER MEMORIES. A.H.Ashley and E.U.Cohler.
Electronics, Vol. 33, No. 13, 72-4 (March 25, 1960).

A problem in the use of ferrite-core matrix memories of the coincident-current type is the reliable selection of the required output pulse from a background of noise generated by the partial switching of partially-selected cores. The usual solution takes advantage of the observed time-displacement of the peak noise and peak signal outputs by using a carefully timed strobe-pulse to select the signal only. However changes in relative timing caused by temperature variations, transistor ageing and drive-current changes make the use of a fixed strobe unreliable. The method described is to generate a variable strobe-pulse by means of a separate array of cores linked to the memory; in this way any environmental changes affect the noise, signal and strobe-timing delays equally, and more reliable operation is obtained. The use of a 1.8 Mc/s transistor in lieu of an 8 Mc/s type, producing an extra delay of 0.8 μsec, did not introduce any errors in a test system.

G.H.Stearman

621.374.32 : 621.382.3

THE TRANSISTOR AND ITS CIRCUITS. See Abstr. 3655.

621.374.32 : 681.142

STATE-LOGIC RELATIONS IN AUTONOMOUS SEQUENTIAL NETWORKS. See Abstr. 3860

621.374.32 : 621.318.1 : 539.2 : 538.1

EFFECT OF GEOMETRY ON THICK FILM TOROIDS. See Abstr. 4109

621.374.32 : 621.318.1

MILLIMICROSECOND MAGNETIZATION REVERSAL IN THIN MAGNETIC FILMS. See Abstr. 4108

621.374.32

4215 TAPE TARGET CLASSIFIER TRAINS SONAR OPERATORS. M.H.Damon, Jr.
Electronics, Vol. 33, No. 13, 65-9 (March 25, 1960).

The heart of this simulator-type trainer is a tape recording of typical data received from a complete omni-directional acoustic sonar system together with the associated synchronizing, controlling and time signals requisite for training purposes. A 1 in. wide tape with 14 parallel tracks running at 60 in./min is employed. At least 48 separate channels of narrow l.f. range are required and these are recorded as sampled data by pulse-amplitude modulation time-division multiplexing. The sampling rate is 4 kc/s and six channels are multiplexed on each of eight tracks. Except for the tape transport, all circuits are transistorized. Some of the circuits, e.g. f.m. modulators and demodulators, pulse reshaper and audio selection gate, are described.

H.G.M.Spratt

621.374.32 : 681.142

DESIGN CRITERIA FOR AUTOSYNCHRONOUS CIRCUITS. See Abstr. 3857

621.374.32 : 621.389

AN AUTOMATIC FISH EGG COUNTER. See Abstr. 3710

621.374.32 : 681.142

ANALYSIS OF TRL CIRCUIT PROPAGATION DELAY. See Abstr. 3858

621.374.33 : 621.396.96

4216 A TIME GATE FOR ECHO-MEASURING RADAR INSTALLATIONS. J.Bacon and J.Q.Burgess.
I.R.E. Trans Instrumentation, Vol. I-8, No. 3, 79-82 (Dec., 1959).

A design having a linear dynamic range of 50 dB for an error not exceeding ± 0.3 dB is presented. Out-of-gate rejection is 58 dB below maximum signal. Gating is accomplished by using a Zener diode. Signal and gate pulses are separated by using a principle which eliminates balancing. This adds a measure of stability unattainable when using balancing techniques.

621.374.33

4217 LINEAR GATE CIRCUITS USING TRANSISTORS. L.Pénège.
J. Phys. Radium, Vol. 19, Suppl. No. 7, 71-4 (July, 1958). In French.

The following circuits are described: (1) linear high-efficiency gates: (2) suppression of saturating pulses in linear amplifiers.

621.374.35

4218 TRANSISTORIZED SLICER ANALYZES SIGNAL AMPLITUDE. T.A.Bickart.
Electronics, Vol. 33, No. 5, 70, 72 (Jan. 29, 1960).

The circuit performs the operation of detecting when the input signal is in between pre-determined voltage levels. The output consists of constant amplitude pulses whose width equals the time interval during which the waveform lies between the predetermined levels. A simple RC integrator provides a time average of the pulsed waveform as a d.c. signal which is a measure of the probability that the input voltage is within the voltage interval $(V-\Delta V,\ V+\Delta V)$.

J.MacCormack

621.374.4

4219 AN APERIODIC FREQUENCY-MULTIPLIER FOR THE AUDIO-FREQUENCY RANGE. R.Mitterer.
Frequenz, Vol. 14, No. 1, 14-16 (Jan., 1960). In German.

The accuracy of frequency measurements using the counting principle can be increased if the frequency is multiplied. A device is prescribed which decuples frequencies between 100 c/s and 10 kc/s. In this way the accuracy of the measurement is increased 10 times, while the time of measurement remains the same. In this circuit the voltage to be measured is first modified to a sawtooth and applied to the deflection electrodes of the E1T counter tube. At the anode of this tube a signal appears which has a frequency ten times the frequency of the input voltage. E .Maanders

621.374.4

4220 DELAY LINE FREQUENCY DIVIDERS. APPLICATION TO ARITHMETIC CODING.
Y.Amram, H.Guilion and B.Ollivier.
Onde elect., Vol. 38, 653-40 (Aug.-Sept., 1958). In French.

The use of delay lines and anti-coincident circuits to produce pulse codes is described. The basic circuit utilizes a delay line length m T (m is an integer, T is the separation of input clock pulses). The pulses emerging from the delay line are fed together with the input pulses to an anti-coincidence circuit when m pulses will be transmitted and m cancelled. For operation up to 10 Mc/s a single valve circuit is described, the delay line is of the "m"-derived type, the first and last section being formed by the stray capacities of the valve with added inductance. For operation up to 100 Mc/s two valves with a distributed-parameter coaxial delay-line are used. Details of a parallel coder utilizing several such circuits with eight outputs, to generate numbers from 1 to 120 when it switches itself off are given. A.P.C.Thiele

621.374.42

4221 PARAMETRIC DIODES IN A MASER PHASE-LOCKED FREQUENCY DIVIDER.
M.L.Stitch, N.O.Robinson and W.Silvey.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 218-21 (March, 1960).

The use of an ammonia-beam maser in a portable frequency standard requires a frequency-divider which can be transistorized. A divider which uses no microwave tubes and hence one that can be transitorized is described. An ammonia-maser-controlled signal generator used to tune up the divider is also described. It is found that the use of a parametric-diode frequency-multiplier substantially improves the lock-in performance of the divider. Some data are given for comparing the performance of the maser frequency divider with and without the parametric diode frequency multiplier.

621.374.44

4222 A VOLTAGE-MODULATED VARIABLE PULSE-RATE GENERATOR. E.J.C.Fowell and A.Cowley.
Electronic Engng, Vol. 32, 304-6 (May, 1960).

Describes a pulse generator circuit, the output frequency of which is a linear function of the input voltage. The circuit employs a screen-coupled double Phantastron pulse circulating system with suitable modifications to improve the accuracy of transfer at low output-frequencies. Four output-frequency ranges are provided between 5 and 2500 c/s. A complete circuit diagram together with performance results are included.

621.374.5

4223 DELAY-LINE SPECIFICATIONS FOR MATCHED-FILTER COMMUNICATIONS SYSTEMS.
R.M.Lerner, B.Reiffen and H.Sherman.
I.R.E. Trans Compon. Parts, Vol. CP-6, No. 4, 263-8 (Dec., 1959).

Specifications for a wide-band multitap delay-line are rationalized by the demands of a matched-filter communication system employing a pair of such delay lines. The delay line is specified in terms of time-domain characteristics.

621.374.5

4224 VARIABLE ELECTRONIC DELAY FOR THE MICRO-SECOND REGION. J.F.Vervier and P.C.Macq.
J. Phys. Radium, Vol. 18, No. 10, 603 (Oct., 1957). In French.

An electronic delay network utilizing two EFP60 secondary-emission valves in circuits similar to those discussed in Abstr. 3806 of 1952 is described. The input pulse appears as a rectangular negative pulse at the anode of the first valve, the duration of which can be varied by a capacitor in its grid circuit. This pulse is then differentiated before being applied to the next valve, which is only triggered by the positive pulse corresponding to its trailing edge. The output pulse is taken from the dynode of this second valve and has constant amplitude. One delay line has been constructed variable between 2 and 10 μseconds with a setting accuracy of 0.1 μsecond and another operating in the millimicrosecond region.

A.P.C.Thiele

AMPLIFIERS

(Abstracts on magnetic amplifiers appear also under Inductors . Reactors)

621.375.3

4225 DYNAMIC HYSTERESIS LOOP AS THE CAUSE OF THE FREE DEMAGNETIZATION IN MAGNETIC AMPLIFIERS.
R.Weppler.
Elektrotech. Z. (E.T.Z.)A, Vol. 80, No. 24, 850-4 (Dec. 11, 1959). In German.

The mechanism of formation of the dynamic hysteresis loops is explained in terms of superimposing a complex load of eddy losses onto the static loop. The phase angle of this load decides on the loop width and tilt, negligible tilt being observed with thin laminations. Assuming a high-impedance control circuit and a harmonic-free control circuit and a harmonic-free control current, the operation of the series transductor is examined for the half-wave, the auto-exited and bridge connections. It is shown that during the reverse half-cycle there is an interval when the flux density traverses from the dynamic to the static loop at a constant field. In this interval of "free demagnetization" the e.m.f. induced in the winding follows an exponential function dependent only on the core properties, and cannot be influenced externally, e.g. by the supply voltage. Experimental results are illustrated by oscillograms. Z.A.A.Krajewski

621.375.3

4226 MAGNETIC AMPLIFIERS WITH FAST RESPONSE. E.Schllepp.
Bull. Assoc. Suisse Elect., Vol. 51, No. 6, 249-53 (March 26, 1960). In German.

The characteristics of magnetic amplifiers are discussed. Special attention is paid to the hysteresis loop of the magnetic core material. Two circuits employing magnetic amplifiers are shown in detail. One circuit is specially intended for small signals and the other should be used as a power amplifier. The differences between the two circuits are explained. E.Maanders

621.375.3

4227 SELF-REGULATION IN MAGNETIC–TRANSISTOR AMPLIFIERS. C.E.Hardies and R.L.Van Allen.
Trans Amer. Inst. Elect Engrs I, Vol. 78, 905-9 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A magnetic amplifier has been designed which has a self-regulated output for variations in the supply excitation. In the circuit described a transistor is used as a switch. The self-regulating properties result from the application of magnetic devices called the "transactor" and the "shunt-coupled magnetic amplifier". Circuit diagrams of this amplifier are given, with photographs of the voltage waveforms measured between various points in the circuit. Transfer characteristics for units employing different magnetic-core materials are also presented. Modifications are possible to enable a circuit with a.c. output or a push-pull magnetic–transistor amplifier to be designed. E.Maanders

621.375.3

4228 MAGNETIC AMPLIFIER BINARY-TO-ANALOG CONVERSION. I.Danylchuk and D.Katz.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 909-12 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A magnetic amplifier, biased to a linear part of its input–output characteristics, is supplied with input control ampere-turns from a series of equal-current sources representing the digits of a binary number. The correct weights are given to the digits by providing suitable numbers of turns upon the control windings. A floating analogue output voltage is thus generated at low impedance from binary sources providing only 1 mA of current. For a 10-digit number 3 separate cores are used with differing excitation to maintain accuracy. Advantages claimed are relative insensitivity to power level changes and the inherent power amplification provided, but the response time is long and prohibits dynamic applications. A conversion accuracy of 0.1% is obtained. G.H.Stearman

621.375.4

4229 ESTABLISHMENT OF AN EQUATION FOR THE BEHAVIOUR OF A NON-LINEAR TRANSISTOR AMPLIFIER. I.Gumowski, J.Lagasse and Y.Sevely.
C.R. Acad. Sci. (Paris), Vol. 250, No. 11, 1995-7 (March 14, 1960). In French.

It is shown that the behaviour of a transistor amplifier may be described by a functional first-order differential equation. Various properties of its solutions are described. C.A.Hogarth

621.375.4

4230 TRANSISTOR AMPLIFIER WITH 100 MEGACYCLE BANDWIDTH. J.C.de Broekert and R.M.Scarlett.
Electronics, Vol. 33, No. 16, 73-5 (April 15, 1960).

Design equations are derived from an exact analysis (not presented) by the liberal use of simplifying approximations, retaining — it is claimed — a useful degree of accuracy. Each stage of the amplifier uses a shunt feedback from collector –emitter of a drift transistor consisting of a series combination of inductance and resistance. Five cascaded stages produce a gain of 50 ± 2 dB between 50 ohm terminations over a frequency range of 8 kc/s to 130 Mc/s. J.MacCormack

621.375.4

4231 TRANSIENT PROCESSES IN TRANSISTORIZED D.C. AMPLIFIERS. G.M.Kasprshak and E.L.Orkina.
Elektrichestvo, 1959, No. 12, 55-60 (Dec.). In Russian.

A general analysis of transistor d.c. amplifiers in industrial electronic applications is presented, with particular emphasis on partially inductive loads (usually windings of magnetic amplifiers, saturable reactors, machines etc.). A generalized graphical method is developed, based on an idealized Ic/Uc family of characteristics and load lines, and the results are interpreted in terms of transistor dynamic parameters, load values and supply voltage. The second (experimental) part discusses a number of reproduced oscillograms of I and U surges versus time, with supply voltage, time constant and various discharge components as parameters. The third part consists of a brief analysis of the exponential current function and of a comparison of predicted and observed times of rise of switched transistors. A.Landman

621.375.4

4232 CROSS MODULATION AND NONLINEAR DISTORTION IN R.F. TRANSISTOR AMPLIFIERS.
M.Akgün and M.J.O.Strutt.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 457-67 (Oct., 1959).

In order to avoid untractable calculations, the transistor four-pole is assumed to be short-circuited for a.c. at its output and the internal impedance of the signal source is assumed to be zero. Non-linear distortion effects in a grounded-base intrinsic transistor are calculated. The formulae are then reverted to a grounded-emitter intrinsic transistor, taking into account the extrinsic base-lead resistance. They are confirmed by measurements of third-harmonic distortion and of cross-modulation. The measured curves of cross-modulation versus collector bias-current show a sharp minimum. This unexpected effect is explained by an extension of the theory which takes into account previously neglected terms. The explanation is successfully tested by experiments. Comparisons with cross-modulation in amplifier tubes are made.

621.375.4

4233 LOGARITHMIC AMPLIFIER DESIGN. S.J.Solms.
I.R.E. Trans Instrumentation, Vol. I-8, No. 3, 91-6 (Dec., 1959).

The logarithmic amplifier is useful for signal compression, analogue computation and i.a.g.c. in wide-range pulse receivers; it has numerous possible applications in instrumentation. A lin.–log. amplitude characteristic may be obtained by cascading a number of stages having a dual-slope amplitude characteristic. This approximation, being analysed in detail, leads to expressions for dynamic range and approximation error. Measurement of the bandwidth of a lin.–log amplifier is discussed as well as maximization of bandwidth as affected by the choice of the number of stages. The problem of temperature compensation as it affects bandwidth and power consumption is also discussed. The problem of recovery transients imposed by the use of a.c. coupling and the advantage of bipolar design for the control of recovery characteristics are discussed. A lin.–log. transistor bipolar amplifier design having an 80 dB dynamic range and a small signal bandwidth of 2.5 Mc/s is presented. Experimental results including temperature effects and pulse response characteristics are given. The dependence of the amplitude response on duty factor imposed by the a.c. coupled bipolar design is mentioned.

621.375.4

4234 CHARACTERISTICS OF DEGENERATIVE AMPLIFIERS HAVING A BASE–EMITTER SHUNT IMPEDANCE.
W.D.Roehr.
I.R.E. Trans Audio, Vol. AU-7, No. 6, 165-9 (Nov.-Dec., 1959).

In amplifiers having emitter degeneration, an impedance is sometimes used between base and emitter. A common case occurs when several emitter followers are used in cascade. The resistors become necessary in order to provide some measure of stability. In an audio amplifier of similar design it became necessary to know what effect this shunt resistor would have upon the input impedance of the stage. The analysis was performed as a result. Experimental measurements which support the resulting equation are given. This analysis and these measurements led to the discovery of a circuit which would exhibit a high a.c. input impedance, yet the resistors in the d.c. base circuit could be kept low to provide good stability. Although it can be shown that circuit power gain is the same regardless of whether a resistor is used in series with the emitter or the base to obtain a high input impedance, consideration of d.c. stability and distortion demand a more thorough investigation of this problem. Design principles are outlined for this high input impedance stage and an example is worked out in detail. Supporting measurements are given.

621.375.4

4235 STABILITIES OF COMMON EMITTER AND EMITTER FOLLOWER TRANSISTOR AMPLIFIERS. B.D.Wedlock.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1657-8 (Sept., 1959).

The inclusion of an emitter resistance in series with the emitter lead of a common-emitter amplifier stage leads to greater stability of current, voltage and power gains against variations in common-emitter current gain. A technique is outlined whereby a circuit may be designed for a given stability requirement. The study is extended to the emitter-follower circuit. J.MacCormack

621.375.4

4236 TUNNEL (ESAKI) DIODE AMPLIFIERS WITH UNUSUALLY LARGE BANDWIDTHS. E.W.Sard.
Proc. Inst. Radio Engrs, Vol. 48, No. 3, 357-8 (March, 1960).

The bandwidth of an amplifier, whose essential element is the frequency-invariant negative conductance in shunt with a parasitic capacitance, is limited and tends to decrease with increasing gain. The bandwidth obtained by resonating this parasitic capacitance with an inductance may be extended by using maximally-flat filter circuits; the gain–bandwidth product becomes $(\text{power gain})^{1/2n}$ times bandwidth where n is the number of poles of the filter. Theoretical and experimental results are provided for n = 1, 2 and 3.
J.MacCormack

621.37..4

4237 PULSED EMITTER-FOLLOWER. B.N.Faizulaev.
Radiotekhnika, Vol. 15, No. 1, 60-7 (Jan., 1960). In Russian.

The transistor emitter-follower is analysed for large signal operation and RC loading. Equivalent circuits are presented as well as expressions for the input and output impedances. Transfer functions and graphs showing the step response are given both for linear

and nonlinear operation (nonlinear operation occurs when the input signal is sufficient to cut off the base current of the transistor).
B.Dentskevich

621.375.422

4238 JUNCTION TRANSISTOR CIRCUITS. CALCULATION OF TEMPERATURE DRIFT. J.J.Ward.
Electronic Technol., Vol. 37, No. 4, 143-5 (April, 1960).
For abstract, see Abstr. 2973 of 1960.

621.375.422

4239 A TRANSISTOR TEMPERATURE ANALYSIS AND ITS APPLICATION TO DIFFERENTIAL AMPLIFIERS. W.Steiger.
I.R.E. Trans Instrumentation, Vol. I-8, No. 3, 82-91 (Dec., 1959).
The equivalent input-drift of an amplifier, which is the correction necessary at the input to restore the output to its "pre-drift" condition, is a convenient concept for the temperature analysis of transistor differential amplifiers. General expressions are derived for the equivalent input-drift of a d.c. amplifier with one transistor. The results are then applied to differential stages. Conclusions for the design of low-drift differential amplifiers are drawn with the possibilities of drift compensation being taken into consideration. Experimental verification indicates that it is possible to reduce the equivalent input-drift voltage under certain conditions to the order of 1 mV per 100° C.

621.375.68

4240 AN ALTERNATING CURRENT ROTARY AMPLIFIER. I.P.Kopylov and V.I.Radin.
Elektrichestvo, 1959, No. 11, 56-60 (Nov.). In Russian.
An experimental machine has been built which combines a single-phase series commutator motor and an auto-excited transductor in one unit. The 127 V, 50 c/s, 3 kW machine weighs 67 kg. With $\cos\varphi = 0.96$ and $\eta = 0.7$ its power gain is 3000 at 9000 rev/min. Long air gap and narrow zones contributed to weaken armature reaction and to achieve satisfactory commutation. Conditions of the common magnetic system are discussed and characteristics presented.
P.Szekely

621.375.9

4241 THE MANLEY–ROWE RELATIONS. P.A.Clavier.
Proc. Inst. Radio Engrs, Vol. 47, No. 10, 1781-2 (Oct., 1959).
A further derivation of the Manley–Rowe relations from the law of conservation of energy (see Abstr. 3620 of 1960). The derivation can be extended to the case where more than two fundamental frequencies exist.
G.D.Sims

621.375.9

4242 THE STRAIGHT REACTANCE AMPLIFIER AS A LOW NOISE PREAMPLIFIER IN THE U.H.F. BAND. R.Maurer, K.H.Löcherer and K.Bomhardt.
Arch. elekt. Übertragung, Vol. 13, No. 12, 509-24 (Dec., 1959). In German.
A reactance pre-amplifier followed by a triode stage is studied in detail. The minimum n.f. for a given bandwidth is found, as is the r.f. for a matched system. Measurements for a signal at 510 Mc/s, pump 1800 Mc/s at 5% bandwidth showed a reduction in n.f. by a factor of 4.
A.H.W.Beck

621.375.9

4243 AN EXTENSION OF THE MODE THEORY TO PERIODICALLY DISTRIBUTED PARAMETRIC AMPLIFIERS WITH LOSSES. K.Kurokawa and J.Hamasaki.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 10-18 (Jan., 1960).
For the extension of the mode theory of the lossless periodically distributed parametric amplifier to the lossy case, a "conjugate circuit" is introduced. This is an imaginary circuit which is obtained in the pass band by replacing each resistance in the original circuit with the negative resistance of the same magnitude. The orthogonality properties between the modes of the original circuit and those of the conjugate circuit are derived. The power gain and the noise figure of the amplifier are calculated, showing the usefulness of this mode theory in accounting for the spreading resistance of the semiconductor diode.

621.375.9

4244 PARAMETRIC DEVICES AND MASERS: AN ANNOTATED BIBLIOGRAPHY. E.Mount and B.Begg.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 2, 222-43 (March, 1960).
This bibliography of 379 items is restricted to books and periodical articles published prior to October, 1959. No attempt has been made to include material found in technical reports, patents or similar sources. Although the greatest portion of the bibliography has to do with microwave devices, the references include some devices operating outside of the microwave frequency range, such as the optical, infrared and radiofrequency masers, and the parametrons.

621.375.9

4245 PHASE CONSIDERATIONS IN DEGENERATE PARAMETRIC AMPLIFIER CIRCUITS. G.A.Klotzbaugh.
Proc. Inst. Radio Engrs, Vol. 47, No. 10, 1782-3 (Oct., 1959).
The negative resistance introduced into the signal circuit of a degenerate parametric amplifier is calculated as a function of the phase angle between the pump and signal voltages. Curves of the variation are given for the cases of coupling via both nonlinear inductance and nonlinear capacitance in terms of other significant parameters.
G.D.Sims

621.375.9

4246 LOW NOISE PARAMETRIC AMPLIFIER. N.Houlding.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2025 (Nov., 1959).
It is pointed out that a reduction in the proportion of damping caused by the varactor can be achieved by increasing the coupling of the source and load. The drive then has to be increased to generate a larger negative conductance. The advantage of this method, as opposed to reduction of the varactor coupling is that the conversion and gain are rendered less sensitive to pump level variations.
G.D.Sims

621.375.9

4247 COMPARISON OF GAIN, BANDWIDTH AND NOISE FIGURE OF VARIABLE-REACTANCE AMPLIFIERS AND CONVERTORS. J.D.Pearson and J.E.Hallett.
Proc. Instn Elect. Engrs, Paper 3224 E, publ. May, 1960 (Vol. 107 B, 305-10).
Formulae are derived for the gain-bandwidth products and noise figures of a variable-reactance amplifier and a convertor. It is shown that for equal gains and noise figure the convertor has a greater bandwidth than the amplifier. This is confirmed experimentally with a circuit operated as a straight amplifier and a convertor.

621.375.9

4248 TRAVELING-WAVE TUBE EQUATIONS INCLUDING THE EFFECTS OF PARAMETRIC PUMPING. J.S.Cook and W.H.Louisell.
Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2016 (Nov., 1959).
A preliminary summary of the fundamental equations used, and the results obtained, in an investigation of the performance of a parametrically-pumped travelling-wave tube (the full investigation to be published later). The main results quoted are the mode amplitudes of the normal forward and backward transmission-line modes, and the slow and fast space-charge wave-modes for the pumped case.
G.D.Sims

621.375.9

4249 LOW NOISE ELECTRON-BEAM AMPLIFIERS. J.Labus.
Arch. elekt. Übertragung, Vol. 14, No. 2, 49-53 (Feb., 1960). In German.
For background see Adler et al. (Abstr. 2355 of 1960). In the devices described here the interaction is with a field of circular polarization and gain still exists when the signal frequency ω is above the cyclotron frequency ω_c. A relation between the pump frequency and the phase velocity of the delayed quadrupole wave shows that the pump frequency may be below the signal frequency.
A.H.W.Beck

621.375.9 : 538.56

4250 VALIDITY OF THE THEORY OF DOUBLE STREAM AMPLIFICATION. D.T.Swift-Hook.
Phys. Rev., Vol. 118, No. 1, 1-5 (April 1, 1960).

Misunderstandings have recently arisen [Abstr. 1951 of 1956; 7111A of 1959, Phil. Mag.(Eighth Ser.), Vol. 3,1241-55 (Nov., 1958)] concerning the validity of the original analysis of the interaction between interpenetrating ion streams to give double stream amplification. It is shown that none of the modes of propagation upon which criticism has been centered corresponds to that of double stream amplification. A direct theoretical proof of the validity of the theory is given.

621.375.9 : 621.385.6

4251 A MICROWAVE ADLER TUBE. T.J.Bridges and A.Ashkin.

Proc. Inst. Radio Engrs, Vol. 48, No. 3, 361-3 (March, 1960).

The construction and performance of an electron-beam parametric amplifier using the principle proposed by Adler (Abstr. 2355 of 1960) are described. First experiments show that the noise figure is 2.5 dB measured near the centre frequency for double-channel operation. Gains of up to 24 dB at a bandwidth of 67 Mc/s between 3 dB points have been obtained. S.A.Ahern

621.375.9

4252 A DOUBLE PUMPING SCHEME APPLICABLE TO LOW-FREQUENCY MASERS. J.E.King, A.Birko and G.Makhov.

Proc. Inst. Radio Engrs, Vol. 47, No. 11, 2025 (Nov., 1959).

The scheme, referred to as "parallel" pumping, requires a paramagnetic crystal with two neighbouring levels from which pumping can be achieved by the same cavity mode and klystron frequency. The use of two levels rather than one could improve the performance by a factor of two. The scheme is of particular importance for low-frequency operation, e.g. gain bandwidth products in excess of 40 Mc/s have been obtained at 14 kMc/s at 4.2°K. G.D.Sims

621.375.9 : 538.56

4253 OPERATION OF A CHROMIUM DOPED TITANIA MASER. H.J.Gerritsen and H.R.Lewis.

J. appl. Phys., Vol. 31, No. 3, 608 (March, 1960).

A maser using Cr^{3+} ions in titania was operated in the 10 kMc/s band using a 35 kMc/s pump, and at 22.3 kMc/s with a pump frequency of 49.9 kMc/s. The gain bandwidth product at X band and 4.2°K was 25 Mc/s. Because of its high zero field splitting, this material may have advantages over ruby at millimetre wavelengths. D.Walsh

621.375.9 : 538.56

4254 PULSED FIELD MILLIMETER WAVE MASERS. L.R.Momo, R.A.Myers and S.Foner.

J. appl. Phys., Vol. 31, No. 2, 443 (Feb., 1960).

Ruby, for use as a three-level maser, is saturated with 12.7 kMc/s. The pump source is gated off within 10 microsec. of the start of a high magnetic field pulse up to 30 kOe. Maser action was observed at 14 different emission frequencies up to 70 kMc/s. A power output of 0.025 W was obtained at 40 kMc/s. The data show that the field dependence of relaxation time in ruby is small. H.Motz

621.375.9 : 538.56

4255 EFFECT OF NUCLEAR POLARIZATION ON THE BEHAVIOUR OF SOLID STATE MASERS. G.Makhov, L.G.Cross, R.W.Terhune and J.Lambe.

J. appl. Phys., Vol. 31, No. 5, 936-8 (May, 1960).

It was observed that the application of an r.f. field near the frequency of quadrupole resonance of the aluminium nuclei in ruby, produced a marked change in the electron-spin resonant absorption under saturation conditions. Application of 10-100 mW of r.f. power at frequencies between 0.5 and 20 Mc/s changed the mode of operation of an X-band maser from the normal c.w. mode to a relaxation mode. The applied r.f. decreased the negative magnetic Q by about 20% and the result is similar to that which might be obtained with added pumping. G.D.Sims

621.375.9 : 538.56

4356 SUPER-RADIATION AND SUPER-REGENERATION. C.Greifinger and G.Birnbaum.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 3, 288-93 (July, 1959).

The transient behaviour of a two-level spin system coupled to an electric circuit is investigated by using the equations of Bloembergen and Pound (Abstr. 8552 of 1954). The equations are solved, in the limit where the circuit ringing time is very short compared with all other characteristic times, for two cases : (1) the spin-lattice and spin–spin relaxation times both infinite, with an externally applied driving field; and (2) the spin-lattice relaxation time infinite but the spin–spin relaxation time finite, in the absence of an external field. In case (1), it is shown that the motion of an inverted magnetization under the action of an applied signal consists roughly of two stages: in the first stage, the effect of radiation damping is unimportant and the motion of the system is determined principally by the applied signal via the ordinary Bloch equations, whereas in the second stage, the motion is essentially the same as if the applied signal had been turned off and only radiation damping were present. In case (2), it is shown that a delayed peak in the emitted radiation should be observed under certain conditions. The delayed peak condition is identical with that derived by Bloom (Abstr. 8938 of 1958). Curves are presented showing the peak power and the time at which the delayed peak occurs as functions of the relevant parameters. In connection with the ordinary maser behaviour of a two-level spin system, it is shown that for values of the parameters typical of steady-state maser amplification, the effects of radiation should be unimportant. Finally, systems are examined for which the radiation damping time is much shorter than all other characteristic times (super-regenerative systems). It is indicated how such systems might be operated as one-shot multivibrators or as linear amplifiers. For the latter type of operation, an expression for the gain is derived which is found to be similar to that encountered in ordinary circuit theory.

621.375.9

4257 THEORETICAL LIMITATIONS TO FERROMAGNETIC PARAMETRIC AMPLIFIER PERFORMANCE. R.W.Damon and J.R.Eshbach.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 4-9 (Jan., 1960).

It has been commonly expected that improved operation of the ferrite parametric amplifier could be obtained by use of materials of narrower resonance linewidth, ΔH. This parameter is critical in determining the pumping power (P_p) required for operation of the device. Also of importance, however, is the limitation of device properties determined by the dependence on ΔH of the instability threshold of the spin-wave system. Considering this limitation, the maximum voltage gain–fractional bandwidth product ($g_p\Delta\omega/\omega_1$) has been determined as a function of other device parameters and typical values calculated for several modes of operation. In the electromagnetic mode, for example, there is an optimum ΔH which yields maximum $g_p\Delta\omega/\omega_1$ at a given pumping power. It is also shown that a minimum filling factor, also a function of ΔH for some types of operation, is required to reach the oscillation threshold even in the unloaded device.

621.375.9 : 621.382.23

PARAMETRIC AMPLIFIER USING SILVER-BONDED Ge DIODE. See Abstr. 3645

MODULATION . DEMODULATION

621.376

4258 THE EXCITATION OF FREQUENCY-AND AMPLITUDE-MODULATED OSCILLATIONS IN LINEAR SYSTEMS. I.T.Turbovich.

Radiotekhnika, Vol. 14, No. 1, 30-4 (Jan., 1960). In Russian.

For previous work, see Abstr. 1742 of 1958. The output voltage of the linear system is expressed as a Duhamel integral and hence obtained as the product of the input voltage and a dynamic transmission coefficient for the system. The exact expression for this dynamic coefficient is reduced to a form suitable for practical calculations. D.E.Brown

621.376.223

4259 RECTIFIER MODULATORS. ANALYSIS BY SUCCESSIVE APPROXIMATIONS. D.P.Howson.

Electronic Technol., Vol. 37, No. 4, 158-62 (April, 1960).

A general set of equations for the series-rectifier modulator having been obtained, a method of reducing the complexity of these equations without undue loss of accuracy is postulated. The resultant simplified set of equations is then shown to be soluble in some cases by successive approximation. The process outlined is applied to a

modulator with constant resistance terminations, and the results are compared with the known exact values. The significance of the discrepancies is discussed. Finally, a modulator with pure capacitance load is analysed, and the results are compared with experimental figures.

621.376.223

4260 RECTIFIER MODULATORS WITH FREQUENCY-SELECTIVE TERMINATIONS.

D.P.Howson and D.G.Tucker.

Proc. Instn Elect. Engrs, Paper 3051 E, publ. Jan., 1960 (Vol. 107B, 261-72, 281-4).

Republication, with discussion, of the paper already abstracted as Abstr. 358 of 1960.

621.376.23

4261 COMPARISON OF DEVIATIONS FROM SQUARE LAW FOR R.F. CRYSTAL DIODES AND BARRETTERS.

G.U.Sorger and B.O.Weinschel.

I.R.E. Trans Instrumentation, Vol. I-8, No. 3, 103-11 (Dec., 1959).

The properties of barretters and crystal diodes as square-law video detectors are examined both theoretically and experimentally. The deviation from square-law characteristic as a function of input and output levels is presented. Maximum r.f. levels and audio output levels at which the over-all deviation exceeds 0.1 dB are given for the PRD 610A, PRD 631C, FXR Z220A barretters and for the 1N32 crystal diode at frequencies between 1 and 10 Gc/s. Minimum usable signals are also discussed, and the maximum range of accurate power ratio measurements is shown to be approximately 53 dB for a barretter and 38 dB for a video crystal. However, the crystal has the advantage in that the lower edge of its accurate range is 20 dB below that of the barretter.

621.376.23

4262 SOME RELATIONSHIPS IN OPTIMAL SIGNAL DETECTION SYSTEMS. L.S.Gutkin.

Radioteknika, Vol. 15, No. 2, 47-57 (Feb.); No. 4, 21-6 (April, 1960). In Russian.

A receiving system based on detection and comparison of the inverse probability of a number of possible signals is considered. Approximate expressions are developed for the system sensitivity against a white-noise background. The error resulting from the use of these expressions does not exceed 0.5 to 1dB for a 10% probability of loss of signal, and tends asymptotically to zero as this probability decreases. The analysis is carried out for single-channel (binary) and multichannel detection of three types of signal:- exactly known; with arbitrary phase; slowly fluctuating (fading). F.Quelon

621.376.232.2

4263 IMPROVEMENT IN THE SQUARE LAW OPERATION OF 1N23B CRYSTALS FROM 2 TO 11 kmc.

A.Staniforth and J.H.Craven.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 111-15, (Jan., 1960).

The conditions required to increase the dynamic range over which square-law response may be achieved were investigated experimentally. Results obtained indicate that a forward bias current of 100 μA or more with a low video load resistance makes the operation of the crystal closer to the ideal square-law over a larger dynamic range.

621.376.234

4264 THE INPUT IMPEDANCE OF RECTIFIER MODULATORS. D.G.Tucker.

Proc. Instn Elect. Engrs, Paper 3187 E, publ. Jan. 1960 (Vol. 107B, 273-81, 281-4).

Republication, with discussion, of the paper already abstracted as Abstr. 361 of 1960.

621.376.3 : 621.396.61

4265 PRACTICAL CONSIDERATIONS IN THE DESIGN OF MINIMUM BANDWIDTH DIGITAL FREQUENCY MODULATION SYSTEMS USING GAUSSIAN FILTERING. W.L.Glomb.

I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 284-90 (Dec., 1959).

The characteristics of a digital f.m. system are reviewed. The Gaussian frequency response is specified and optimum filters for transmitter and receiver (both predetection and postdetection) are developed. The relationship between peak deviation and system threshold is explored and an optimum deviation established. The location of the Gaussian filters in the system is discussed. It is shown that for best threshold performance, all receiver filtering should be predetection filtering and that optimum peak deviations under these conditions may correspond to the –44 dB point of the i.f. filter. Practical details of transmitter and receiver design are discussed. These results were applied to 2 Gc/s communication equipment.

621.376.3 : 621. 372.6

4266 NETWORK RESPONSE TO TRANSIENT FREQUENCY MODULATION INPUTS. T.T.N.Bucher.

Trans Amer. Inst. Elect. Engrs I, Vol. 78, 1017-22 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

Calculation of output from linear passive network with f.m. input is difficult for all but the simplest cases. Suitable approximations are derived for rather general network functions, when the input modulation varies rapidly during a relatively short period. For this purpose the meaning of "instantaneous" amplitude and phase are considered. T.Horrocks

621.376.32

4267 MAGNETIC MODULATORS WITH PERPENDICULARLY SUPERPOSED MAGNETIC FIELDS.

F.I.Kerbnikov and M.A.Rozenblat.

Avtomat i Telemekh., Vol. 19, No. 9, 836-48 (1958). In Russian.

The operation and the design of magnetic modulators are considered. Formulae for first and second harmonics of the output voltage for the corresponding types of modulator are obtained. Theoretical results are confirmed by experimental data.

ELECTRONICS

SEMICONDUCTOR MATERIALS AND DEVICES

TRANSISTORS

621.382 : 539.2 : 537.311

4268 CONTRIBUTION TO THE KNOWLEDGE OF ION MOVEMENT IN SEMICONDUCTORS. F.Ollendorff.

Arch. Elektrotech. (Berlin), Vol. 45, No. 1, 10-26 (1960). In German.

An attempt is made to describe the movement of an ion in a homogeneous and isotropic semiconductor on the basis of a braking force set up by a tail of anti-polar carriers. A mathematical treatment of the effect of this force on the current density and potential of the semiconductor is given. G.C.Williams

621.382

4269 P-N-P-N SEMICONDUCTOR COMPONENTS. U.Krabbe and N.Meyer.

Ingeniøren B, Vol. 69, No. 8, 249-58 (April 15, 1960). In Danish.

The physical mechanism of p-n-p-n components is examined on the basis of the established theory of the junction diode and the transistor. The characteristics of the p-n-p-n diode are analysed in terms of the transistor equivalent circuit, followed by an account of the inverse p.n.p.n triode (the hook transistor) and the normal p-n-p-n triode. The use of the hook transistor in pulse circuits — multivibrators, impulse generators and frequency dividers — is considered. In power applications, an account is given of p-n-p-n triodes used in association with or as a replacement for transductors in the control of rectifiers, and the use of the triode themselves as inverters. G.N.J.Beck

621.382

4270 GENERATION–RECOMBINATION NOISE IN SEMICONDUCTORS — THE EQUIVALENT CIRCUIT APPROACH. K.S.Champlin.

I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 29-38 (Jan., 1960).

Generation–recombination noise in semiconductors in thermal equilibrium is treated from the standpoint of thermal fluctuations in

equivalent electrical circuits. For the general volume recombination model, a method based on network reduction is presented which allows one to calculate the spectral density of the electron and hole fluctuations without solving for the spectra of the fluctuations in occupancy of the recombination centres and traps. The method is extended to a surface recombination model, thereby avoiding the ambiguities found in previous formal treatments. It is shown that the concept of ambipolar diffusion, the location and spectral density of the random sources, and the spatial correlation of Fourier coefficients of carrier density fluctuations all have simple significance in electrical terms. Using transmission line techniques, the generation-recombination (GR) spectrum is calculated for a two-level semiconductor where recombination occurs at opposite plane surfaces. This new result is examined in detail for the limiting cases approached when the recombination process is (1) volume-limited; (2) surface-limited; and (3) diffusion-limited. It is shown that in the first two cases, the spectrum is identical with that obtained from a zero-dimensional analysis provided the time constant is properly defined. For the diffusion-limited case, however the spectrum varies as $1/\omega^{3/2}$ at high frequencies, and at low frequencies the noise is $\frac{2}{6}$ that predicted by the simple theory. The new result is shown to compare favourably with measurements reported previously by Hill and van Vliet [see Abstr. 1454A of 1959; Physica, Vol. 24, No. 9, 709-20 (Sept., 1958)].

621.382 : 539.2 : 537.311

4271 INTERVALLEY NOISE. P.J.Price.

J. appl. Phys., Vol. 31, No. 6, 949-53 (June, 1960).

A theory is developed for the spectrum of electrical noise due to electron transitions between several quasi-isolated groups of states, in the general case where each group may carry part of an electric current. It is applied to the noise due to transmission between valleys of the conduction band of germanium, and the possibility of observing this noise is discussed using the data of Weinreich, Sanders and White on the frequency of intervalley transitions [Abstr. 6969 A of 1959; Phys. Rev., Vol. 114, No. 1, 33-44 (April 1, 1959)].

621.382 : 621.791.335

4272 IMPROVED SEMICONDUCTOR-TO-COPPER SOLDERED CONTACT. G.Reichenbaum.

Brit. J. appl. Phys., Vol. 10, No. 10, 469-70 (Oct., 1959).

The solder is allowed to spread into the semiconductor-base metal gap by capillary action from a small pellet in a groove on one side. Over 90% wetting is claimed in every device made in this way, thereby ensuring good transient overload characteristics.

F.F.Roberts

621.382 : 539.2 : 537.311

4273 EQUIPMENT FOR THE ENCAPSULATION OF SEMICONDUCTOR DEVICES. R.D.Knight.

J. sci. Instrum., Vol. 37, No. 6, 197-9 (June, 1960).

A hydraulically operated ram carries the semiconductor device and its envelope, loosely assembled, into a Pyrex chamber. Here the two are separated while the envelope is outgassed by e.c.h. in vacuum. They are then brought together, in vacuum or in gas, and the residual heat in the envelope melts a ring of tin in the mount collar to make the final seal. During the process the device is warmed sufficiently to drive off any moisture. A novel three-port valve controls the gas and vacuum supplies to the chamber. The equipment has been designed with a view to ultimate automation.

621.382 : 539.2 : 537.311

4274 RECTIFICATION WITHOUT INJECTION AT METAL-TO-SEMICONDUCTOR CONTACTS. N.J.Harrick.

Phys. Rev., Vol. 118, No. 4, 986-7 (May 15, 1960).

The author has shown that extraction in the semiconductor bulk may occur for either direction of current flow through the same metal-to-semiconductor contact when an insulating layer separates the metal and the semiconductor and the field effect determined the surface barrier under the metal. It is shown here that strong rectification, whose direction depends only on the bulk type, may occur for such contacts to extrinsic, but not intrinsic, semiconductors. Thus, rectification, without injection, may occur at the metal-to-semiconductor contact for the two-carrier system.

621.382 : 621.396

SEMICONDUCTOR DEVICES IN MOBILE RADIO-COMMUNICATION EQUIPMENTS. See Abstr. 3737

621.382.2

4275 NEGATIVE RESISTANCE IN SEMICONDUCTOR DEVICES. R.E.Burgess.

Canad. J. Phys., Vol. 38, No. 3, 369-75 (March, 1960).

Negative resistance can appear in the static and high-frequency characteristics of devices in which the current is determined by both voltage and temperature. The properties of the a.c. impedance arising from the interaction of thermal and non-thermal effects are discussed and criteria for the appearance of negative resistance over certain ranges of frequency are derived. The application of this analysis to devices which do and which do not exhibit isothermal negative resistance is considered. A current–temperature relation depending on two activation energies is shown to provide a quantitative model for interpreting the observed turnover behaviour of germanium diodes.

621.382.2

4276 MICROWAVE DIODE CARTRIDGE IMPEDANCE. R.V.Garver and J.A.Rosado.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 104-7 (Jan., 1960).

In any application of a semiconductor microwave diode, the impedance of the diode cartridge plays a very important role. Two commonly made assumptions, which are quite erroneous, are that (1) the impedance of the diode cartridge consists simply of a shunt capacitance and whisker inductance, and (2) the metal-to-semiconductor junction at microwave frequencies behaves approximately as it does at 10 Mc/s. It is shown that the impedance of the diode cartridge at microwave frequencies can be measured accurately by substituting a carbon die for the semiconductor.

621.382.2

4277 THEORY OF THE GERMANIUM DIODE MICROWAVE SWITCH. R.V.Garver, J.A.Rosado and E.F.Turner.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-8, No. 1, 108-11 (Jan., 1960).

The application of a generally neglected theory of microwave detection to the poorly understood problem of metal-to-semiconductor junction behaviour at microwave frequencies is discussed. Experimental results are disclosed which support the theory and appear to be the first experimental verification of it. It is shown how the theory predicts that germanium microwave diodes should exercise direct switching action upon microwaves while silicon microwaves diodes should not, as had been observed in the past but with no explanation.

621.382.2

4278 ON THE PROBLEMS OF COOLING SEMICONDUCTOR ELEMENTS, DIODES AND TRANSISTORS. SIMPLE CALCULATION OF THE THERMAL RESISTANCE OF COOLING STRUCTURES AND DETERMINATION OF THE MAXIMUM DISSIPATED POWER. J.P.M.Seurot.

Onde elect., Vol. 40, 164-82 (Feb., 1960). In French.

Outlines the basic laws of cooling by conduction, convection and radiation, and gives an equivalent thermal circuit-diagram to represent the cooling of power transistors and diodes. A simple algebraic formula is developed for the thermal resistance of a flat cooling structure in terms of its conductivity, convection and radiation. Graphs calculated from it compare favourably with measured values. The results are used to determine the maximum power which can be dissipated by commercial transistors, and the application of the formula to complicated cooling structures and to forced air-cooled and water-cooled units is considered.

E.F.Hansford

621.382.2

4279 FREQUENCY DEPENDENCE OF THE EQUIVALENT SERIES RESISTANCE FOR A GERMANIUM PARAMETRIC AMPLIFIER DIODE. S.T.Eng and R.Solomon.

Proc. Inst. Radio Engrs, Vol. 48, No. 3, 358-9 (March, 1960).

A new model is proposed for the equivalent circuit of a zero- or reversed-biased diode which takes into account the observed frequency-dependence of the circuit elements. Instead of the normal circuit, consisting of a parallel combination of a transition capacitance and dynamic barrier-resistance in series with a bulk resistance, the transition capacitance is shunted by a resistance R_{S1} in series with a parallel combination of resistance and capacitance R_{S2} and C_S. The resistor R_{S1} is a surface resistance subject to ambient conditions and R_{S2} expresses the dependence of the reverse current on the surface recombination rate. C_S is the capacitance associated with the surface space-charge region.

J.MacCormack

621.382.23

4280 IMPROVEMENT OF SEMICONDUCTOR SURFACES BY LOW MELTING GLASSES, POSSIBLY FUNCTIONING AS ION GETTERS. S.S.Flaschen, A.D.Pearson and I.L.Kalnins.
J. appl. Phys., Vol. 31, No. 2, 431-2 (Feb., 1960).

Coating surfaces of p–n diffused-junction silicon diodes with low melting point sulphide and iodide inorganic glasses has resulted in a decrease of reverse current by two orders of magnitude from $\sim 10^{-6}$ to $\sim 10^{-9}$ A and an improved stability of the reverse characteristic. Removal of contamination from the surface by chemical diffusion into the glass and/or neutralization of induced surface charges by ion getters are proposed to explain experimental results. G.C.Williams

621.382.23

4281 EFFECT OF MINORITY-CARRIERS ON THE DYNAMIC CHARACTERISTIC OF PARAMETRIC DIODES. I.Hefni.
Electronic Engng, Vol. 32, 226-7 (April, 1960).

An anomalous V–I characteristic for the p-n junction was observed. The effects of this are shown by oscillograph traces and it is suggested that it is due to the existence of minority carriers.

621.382.23

4282 SOME RATING AND APPLICATION CONSIDERATIONS FOR SILICON DIODES. H.C.Lin.
I.R.E. Trans Compon. Parts, Vol. CP-6, No. 4, 269-73 (Dec., 1959).

The dissipation in a silicon rectifier depends on the characteristics of the rectifier (threshold voltage and ohmic resistance) and the circuit constants (inductive, resistive, or capacitive load). Dissipations under these different conditions are calculated. The maximum permissible dissipation is limited by maximum junction temperature and thermal stability. The stability criterion depends on the thermal resistance, the reverse characteristic and its change with respect to temperature, the reverse voltage, and the circuit configuration. Derating curves are obtained, based on known variations of the reverse characteristics of silicon rectifiers with temperature and voltage. The maximum permissible transient dissipation depends on the total surge energy. The energy dissipated in the rectifier is high when the load capacitance is high and the external series resistance is low. A design embodying all the foregoing considerations is illustrated.

621.382.23

4283 DIFFUSED SILICON NONLINEAR CAPACITORS. A.E.Bakanowski, N.G.Granna and A.Uhlir, Jr.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 384-90 (Oct., 1959).

Diffused silicon nonlinear capacitors were fabricated by solid-state diffusion. The resulting graded p–n junction is a planar structure which permits low series resistance R_s relative to the minimum capacitance C_{min} which is measured at a reverse voltage slightly less than the breakdown voltage. A cutoff frequency $f_c = (2\pi R_s C_{min})^{-1}$ is used as a figure of merit; values up to 150 Gc/s were obtained. These "varactor" diodes may be used as u.h.f. and microwave amplifiers and as harmonic generators. The noise figures of the u.h.f. amplifiers are better than the best noise figures obtainable by present electron-tube techniques. These diodes are also efficient harmonic generators.

621.382.232

4284 TUNNEL DIODES. R.N.Hall.
I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 1-9 (Jan., 1960).

A review of properties, principle of operation, and implications of the tunnel diode. Following a brief description of the unusual characteristics of this device, a discussion is given of the mechanism which leads to the negative resistance. Experiments showing the transition from the tunnel diode characteristic to that of a high-voltage avalanche diode are exhibited. The electrical characteristics of tunnel diodes are outlined making use of the small-signal equivalent circuit which represents the behaviour in the negative-resistance region. Diodes designed for h.f. operation are described and examples are given of circuits which demonstrate their behaviour as switches, radio receivers, and microwave oscillators. In connection with a discussion of temperature dependence, experiments are described which demonstrate the importance of phonons in determining their characteristics at the temperature of liquid helium.

621.382.3

4285 THE TUNNEL-EMISSION AMPLIFIER. C.A.Mead.
Proc. Inst. Radio Engrs, Vol. 48, No. 3, 359-61 (March, 1960).

A metal-insulator-metal-insulator-metal structure is proposed in which the two insulator layers are thin enough, have sufficient energy gaps, and are suitably biased, to produce tunnel-effect transmission of electrons from the negative outer metal layer to the middle metal layer and from the latter to the positive outer metal layer, and in which the middle metal layer is thin compared with the electronic mean free path in it. The structure is in principle capable of power gain in an analogous way to a transistor, but the ultimate cut-off frequency, limited by the slope resistance and capacitance of the electron-injecting junction, is estimated to be of the order of 10^{12} c/s. An experimental device made with Al and Al_2O_3 layers had a current "gain" of 0.1-0.3. F.F.Roberts

621.382.3 : 539.2 : 537.311

4286 TRANSISTOR WITH BASE CONTAINING A DISPERSED COLLOIDAL PHASE. B.R.Gossick.
J. appl. Phys., Vol. 31, No. 4, 745 (April, 1960).

The presence of p-type colloidal particles in the base of a p-n-p transistor should increase the gain bandwidth product of the transistor. The colloidal particles cause a reduction in the conductivity of majority carriers, and an increase in the mobility of minority carriers. It is suggested that a dispersed colloidal phase of tin would have this effect in n-type germanium. C.Hilsum

621.382.3

4287 THE SILICON THYRATRON TRANSISTOR. A NEW SILICON SEMICONDUCTOR ELEMENT FOR FAST SWITCHING AT HIGH POWERS. A.Petitclerc.
Onde elect., Vol. 40, 155-60 (Feb., 1960). In French.

The principles of the device are described with particular reference to its switching characteristics, including speed of transition and mean and overload power dissipation. Typical applications briefly outlined include rectification, overload surge protection, motor control and synchronous d.c. converters. T.H D.Attewell

621.382.3 : 621.374.32

4288 A NEW THEORY OF THE TRANSISTOR IN THE SATURATED RÉGIME. SWITCHING PROBLEMS. M.Carbonel.
Ann. Radioelect., Vol. 15, 78-96 (Jan., 1960). In French.

In this theory a two-dimensional model of a transistor is employed: one part, consisting of the centre of the transistor, behaves as an ideal transistor without base current; the other part forms the edges of the transistor and supplies the base current. In Pt I static operation is examined. Equations are derived connecting the base current, the collector current and the collector-emitter voltage. These equations are valid over a wide range, including that in which current reversal occurs. Pt II deals with the presentation of an equivalent circuit diagram, calculation of the charge stored in a transistor, calculation of a "transient β" coefficient used in certain transistor applications (switching), and lastly, calculation of the various usual switching times. The same theory can be applied to various problems: to show the superiority of the physically symmetrical over the asymmetrical transistor for switching purposes, finding the shape, nature and number of electrodes in a transistor required for obtaining a low saturation voltage or high gain. The calculations are generally fairly well verified by the experiments.

621.382.3 : 621.396.621

THE EFFECTS OF VARIATIONS IN TRANSISTOR PARAMETERS ON THE OVERALL PERFORMANCE OF A RADIO RECEIVER. See Abstr. 3742

621.382.3 : 621.372.5

AN APPLICATION OF MATRIX METHODS TO THE DETERMINATION OF LOW- AND HIGH-FREQUENCY EQUIVALENT CIRCUITS OF TRANSISTORS WITH GROUNDED BASE AND GROUNDED EMITTER. See Abstr. 4152

621.382.3 : 621.374.32

TRANSISTOR AS A PASSIVE CIRCUIT ELEMENT. See Abstr. 4212

621.382.333

4289 THE EXECUTION AND DISCUSSION OF COMPARATIVE LIFE-TESTS ON EUROPEAN AUDIO FREQUENCY TRANSISTORS OF VARIOUS MAKES. J.S.Vogel and M.J.O.Strutt. Arch. elekt. Übertragung, Vol. 14, No. 3, 121-30 (March, 1960). In German.

The various factors affecting life performance are discussed, i.e., irradiation, mechanical stresses, humidity, thermal stresses, reliability, load. The ageing effects are shown for six equivalent Ge junction transistors. Special attention is paid to creep in values to be measured and to the so-called "48-hour effect". Of the eleven conclusions given, the main ones are: (a) the first 150 hrs show most changes; (b) a 1000 hrs soak test is of little significance.

A.Sczaniecki

621.382.333

4290 POWER SWITCHING WITH JUNCTION TRANSISTORS. A.N.DeSautels.

Control Engng, Vol. 6, No. 11, 113-17 (Nov., 1959).

Reviews the factors involved in the design of a switching stage in which the powers dissipated in the transistor in the off, on and transient conditions must all be considered. F.F.Roberts

621.382.333

4291 AUTOMATED ASSEMBLY OF ALLOY-JUNCTION TRANSISTORS. T.J.Leach.

Electronics, Vol. 33, No. 13, 57-61 (March 25, 1960).

The machine fabricates the transistors from pre-formed components, emitter and collector dots, the germanium disk, the base washer, the whisker wires, and the mounting base. The dots are first assembled with the germanium disk and alloyed. The base washer and emitter lead are then bonded to the transistor, followed by the collector lead. The base washer is then welded to the transistor mounting base and the emitter and collector wires are welded to the mounting-base posts. Ninety minutes are required to complete the assembly of one transistor, and production is at the rate of one transistor every two seconds. J.MacCormack

621.382.333

4292 GERMANIUM H.F. POWER TRANSISTORS. V.A.Strushinskii.

Fiz. tverdogo Tela, Vol. 2, No. 3, 420-5 (March, 1960). In Russian.

The manufacturing method is based on the thermo-conversion effect (reversible change of n to p type when heated above 500°C), discovered by Theurerer and Scaff. The mechanism of this effect is discussed in detail, the modern view being that it is due to copper impurities existing at three acceptor levels and one donor level. A new manufacturing process is then described based on the use of a metallic emitter electrode of acceptor type with the property of absorbing adjacent copper and changing the germanium layer back to its n-conductivity, thus creating a diffused base and achieving superior r.f. performance (10 dB power gain at 10 Mc/s with an output of 2 watt). A dimensioned drawing of the actual transistor, all relevant electrical data and several curves plotting β versus I_C and temperature, I_C versus U_C, and I_{CO} versus temperature are reproduced. An extensive bibliography is quoted. A.Landman

621.382.333

4293 PREDICTION OF STORAGE TIME IN JUNCTION TRANSISTORS. R.P.Nanavati.

I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 9-15 (Jan., 1960).

It is pointed out that in the prediction of storage time one needs to know only a single fundamental device parameter, the storage time constant T_s. Several methods of measuring T_s are considered and compared both theoretically and experimentally. A single non-oscilloscope method of measuring T_s is discussed and its theory presented. This method holds out the best promise for the ability to predict the storage time of very fast transistors. It is therefore now possible to predict large-signal transient response of transistors on the basis of small-signal non-oscilloscope measurements.

621.382.333

4294 ANOTHER APPROXIMATION FOR THE ALPHA OF A JUNCTION TRANSISTOR. J.M.Rollett.

Proc. Inst. Radio Engrs, Vol. 47, No. 10, 1784-5 (Oct., 1959).

Derives and lists the advantages of the expression:

$$\frac{\alpha(\omega)}{\alpha_o} \approx \frac{1 - j\omega/5\omega_\alpha}{1 + j\omega/\omega_\alpha}$$

F.F.Roberts

621.382.333

4295 TRANSISTOR BEHAVIOUR AT HIGH FREQUENCIES. R.P.Abraham.

I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 59-69 (Jan., 1960).

The tee equivalent circuit for junction transistors was modified to take account of electric field in the base region. This electric field is the result of a graded impurity density in the base region of the transistor. It is shown that a graded base improves the high-frequency performances of the common-base stage; however, the improvement in common-emitter performance is considerably less because of the increased "excess" phase which accompanies the improved high-frequency performance. The complex hybrid parameters are calculated for the common-base and common-emitter configurations; these calculations take into account the parasitic interterminal capacities of the transistor. The common-emitter calculations are compared to measured data, and substantial agreement is obtained.

621.382.333

4296 THE CYLINDRICAL FIELD-EFFECT TRANSISTOR. H.A.R.Wegener.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 442-9 (Oct., 1959).

The characteristics of a cylindrical field-effect transistors are derived analytically on the basis of Shockley's theory of the planar field-effect transistor. It is found that the cylindrical device is capable of giving twice the (voltage) amplification factor of that of the planar device. Its frequency behaviour should be comparable to that of the Shockley unit. Because of the loss of one degree of freedom, the transconductance and power characteristics of the cylindrical field-effect transistor are sharply limited. Experimental data support the analytical results.

621.382.333 : 539.2 : 537.311

4297 MINORITY CARRIER RECOMBINATION IN A CYLINDRICAL TRANSISTOR BASE REGION. D.P.Kennedy.

J. appl. Phys., Vol. 31, No. 6, 954-6 (June, 1960).

An analysis is given on the influence of bulk recombination within the base region of a mesa A-type drift transistor. The minority carrier transport efficiency is established for a solid cylinder base region and also for a simplified one-dimensional structure. A comparison of the two minority carrier transport equations shows the approximate analysis will result in a negligible error when applied to practical semiconductor devices.

621.382.333

4298 THE HIGH-FREQUENCY EQUIVALENT CIRCUIT OF TRANSISTORS. R.Paul.

Nachrichtentechnik, Vol. 9, No. 7, 296-300 (July, 1959). In German.

After a general discussion of equivalent circuits of transistors, equivalent circuits for the emitter, base, and collector regions are developed separately and shown to fit with the physical processes taking place. The high frequency behaviour calculated from the equivalent circuits agrees fairly closely with the measured variations. C.A.Hogarth

621.382.333

4299 THE INTEREST OF THE BASE-DIFFUSED STRUCTURE. O.Garreta.

Onde elect., Vol. 40, 161-3 (Feb., 1960). In French.

Discusses the main features of the mesa transistor structure; the optimization of the maximum frequency of oscillation, the factors affecting cut-off frequency, base resistance and collector capacitance, and the technological factors influencing the final structure chosen. The parameters of a 700 Mc/s Ge unit are summarized.

F.F.Roberts

621.382.333.33

4300 SPACE-CHARGE LAYER WIDTH IN DIFFUSED JUNCTIONS. R.M.Scarlett.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 405-8 (Oct., 1959).

Outlines a calculation of space-charge layer width in a planar junction made by diffusing an n or p impurity (assumed to follow a Gaussian or a complementary error function distribution) into a uniformly doped crystal of opposite conductivity type. The collector junction of most drift transistors conforms closely to this model. An exponential approximation to the impurity distribution permits curves to be drawn of the space-charge layer penetration in each direction from the junction as a function of applied reverse voltage, and of the electric field distribution. The quantities involved are normalized in terms of the initial doping level N_i, the impurity

diffusion length $L = 2\sqrt{Dt}$, and the junction depth x_j. The curves should be useful in calculating depletion-layer capacitance, transistor punch-through voltage and junction breakdown voltage.

PHOTOELECTRIC DEVICES

621.383 : 621.317.7

THE USE OF LIGHT-SENSITIVE COMPONENTS IN THE CONSTRUCTION OF OPTICAL INSTRUMENTS. See Abstr. 4087

621.383 : 621.311.6

SOLAR CELL POWER SUPPLIES FOR SATELLITES. See Abstr. 3961

621.383.2 : 535.37 : 539.2

4301 LIGHT PATTERNS OF ELECTROLUMINESCENT PANELS. Z.Bodó and J.Weiszburg.
Acta phys. Hungar., Vol. 10, No. 3, 341-3 (1959).

Using a photographic technique to integrate the light emitted over a period of time ranging from 8 to 24 hrs, experiments have been performed to identify the position of light emitting regions in electroluminescent ZnS:Cu panels. It was concluded that every light spot was emitted with both polarities of the applied field, although in some cases there was a great difference in intensity with reversal. The difference in intensity upon reversal of the field is explained by grain orientation and/or by asymmetric properties of the lighting regions themselves. I.Cooke

621.383.2 : 539.2 : 535.37

4302 THE EFFECT OF ELECTRICAL PRE-HISTORY OF AN ELECTROLUMINESCENT PHOSPHOR ON THE CHARACTERISTICS OF ITS EMISSION WHEN EXCITED WITH SHORT VOLTAGE PULSES. I.Ya.Lyamichev and I.N.Orlov.
Optika i Spektrosk., Vol. 7, No. 3, 398-406 (Sept., 1959). In Russian.

Phosphors of ZnS:Cu(Pb,Cl) and ZnS:Cu:Cl types were excited with square voltage-pulses from a special generator which produced several independently controlled series of pulses. Each voltage pulse produced a light pulse consisting of two peaks. The mechanism of formation of these peaks is discussed in terms of electrical pre-history; in the case of pulse excitation such pre-history means the duration, period, amplitude etc. of pulses up to a given moment. A.Tybulewicz

621.383.27

4303 STABILIZATION OF THE GAIN OF PHOTOMULTIPLIERS BY EXTERNAL CIRCUITS. G.Pietri.
J. Phys. Radium, Vol. 19, Suppl. No. 7, 111A-116A (July, 1958). In French.

The extreme speed with which the gain of a photomultiplier tube increases when the supply voltage increases is a major reason for difficulties of use of this tube in experimental physics. A simple and efficient gain-stabilization circuit which extends the use of the photomultiplier, particularly in field prospecting, is described.

621.383.4

4304 PHENOMENOLOGICAL DESCRIPTION OF THE RESPONSE AND DETECTING ABILITY OF RADIATION DETECTORS. R.C.Jones.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1495-502 (Sept., 1959).

A general discussion of detectors, summarizing earlier publications on detecting ability. Particular reference is made to photoconductive cells. C.Hilsum

621.383.4

4305 THE MEASUREMENT AND INTERPRETATION OF PHOTODETECTOR PARAMETERS.
R.F.Potter, J.M.Pernett and A.B.Naugle.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1503-7 (Sept., 1959).

The U.S. Naval Ordnance Laboratory provides a service for the evaluation of infrared photocells. A description is given of the apparatus and procedure used for these measurements, which include spectral response, frequency response, noise spectrum and detectivity. C.Hilsum

621.383.4

4306 COOLING TECHNIQUES FOR INFRARED DETECTORS. J.G.Goodenough.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1514-15 (Sept., 1959).

Gas liquefiers working on Joule-Thomson expansion can be made small enough to fit into Dewar-type photoconductive cells. A short description is given of these instruments, and of an alternative cooling technique involving the controlled transfer of liquid nitrogen from a storage vessel to the cell. C.Hilsum

621.383.5 : 621.382.2

4307 DEFINITION AND MEASUREMENTS OF THE NOISE FIGURE OF SEMICONDUCTOR PHOTODIODES, INCLUDING PHOTON NOISE. G.Specha and M.J.O.Strutt.
Scientia Electrica, Vol. 5, No. 4, 121-32 (Dec., 1959). In German.

The noise figure of a photo-diode is defined, taking into account the radiation energy falling on the diode, its spontaneous fluctuation (photon noise), the quantum efficiency, which also undergoes spontaneous fluctuations, and the shot noise of the dark current. Flicker noise is excluded. With the aid of an analogy to partition noise in a tetrode valve an expression for noise figure is derived, and the smallest detectable change of temperature of the radiation is shown to be proportional to it. Measurements on selected germanium p–n junctions confirm the theory. C.Fromberg

PARTICLE ACCELERATORS

621.384.6

4308 LONGITUDINAL ELECTRON MOTION AND TOLERANCES IN LINEAR ACCELERATORS. A.D.Vlasov.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 295-302 (Feb., 1959). In Russian.

The injection conditions of the electron beam in a linear accelerator which ensure efficient acceleration and a compact energy spectrum of the accelerated particles are formulated for an accelerator operating at 10 cm using a waveguide loaded with irises. An estimate is made of the influence of phase velocity errors on the electron output energy which enables the tolerances for frequency, temperature and dimensions of the accelerator to be established. [English summary PB 141106 T-13 obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

ELECTRON TUBES

621.385

4309 MEASURING CATHODE TEMPERATURES. J.H.Affleck.
Electronics, Vol. 33, No. 16, 80-2, (April 15, 1960).

A brief report on measurements made on the A.S.T.M. planar test diode using the retarding field technique and a magnetic field to linearize the trajectories: with no field the retarding field temperatures were considerably too high, with a field they were about 4% low. A.H.W.Beck

621.385.032.213.13

4310 CATHODES FOR HIGH-POWER MICROWAVE VALVES. G.Noel.
Acta Electronica, Vol. 4, No. 1, 71-80 (Jan., 1960). In French.

Describes the technique of preparing the impregnated type of L-cathode. Tungsten matrices are filled with copper, machined and the copper is then boiled out. The impregnation with barium aluminate follows. The performance is not discussed. A.H.W.Beck

621.385.032.213.13 : 537.533

4311 THE POISONING OF IMPREGNATED CATHODES. R.O.Jenkins and W.G.Trodden.
J. Electronics and Control, Vol. 7, No. 5, 393-415 (Nov., 1959).

The poisoning of barium–calcium aluminate impregnated tungsten cathodes by various gases was investigated experimentally. It is shown that oxygen, water vapour, carbon dioxide and air poison

these cathodes, while carbon monoxide, nitrogen and hydrogen do not. Poising takes place with the former gases if a critical pressure, depending on the gas is exceeded, this pressure increasing with cathode temperature. For a normal operating temperature of 1100°C the approximate critical pressures for the gases are as follows: O_2 10^{-7} mm, H_2O 3×10^{-7} mm, CO_2 10^{-5} mm and air 5×10^{-6} mm. Cathodes with two different porosities of tungsten show somewhat different poisoning characteristics. The amount of poisoning increases rapidly with the pressure when once the critical pressure p_0 is exceeded, an equilibrium value of the emission poisoning ratio dependent on p/p_0 being reached. For very severe poisoning, the reactivation time increases with the time the cathode has been held in the poisoned condition, but for small degrees of poisoning the recovery rate depends only on cathode temperature. A theory correlating the various observations is proposed,based on the probabilities of gas adsorption, and rates of barium production, evaporation and migration.

621.385.032.212.63

4312 FIELD EMISSION, A NEWLY PRACTICAL ELECTRON SOURCE. W.P.Dyke.

I.R.E. Trans Military Electronics, Vol. MIL-4, No. 1, 38-45 (Jan., 1960).

The properties of the field emission electron source are discussed. These include high current-density, small size, no heater, instantaneous reponse, and a highly nonlinear current—voltage relationship. Engineering data are then derived including conductance, perveance, beam power, etc. It is shown that the field-emission cathode is electrically stable and that it has long life given suitable environments and/or operating conditions, which are specified. Microwave, voltage control and measurement, electron optical and other applications are discussed. A 300 MW flash X-ray tube now in production is described.

621.385.1

4313 LIFE OF ELECTRONIC TUBES AND SERVICE RELIABILITY. A.Ingignoli, G.Rochat and R.Sartori.

Alta Frequenza, Vol. 28, No. 3-4, 314-29 (June-Aug., 1959). In Italian.

Expressions are derived for the probabilities of failure and survival as functions of time, and these are used to develop an expression for the frequency of substitution of valves in an equipment, given certain criteria for inefficiency of individual valves. It is shown that the frequency of substitution tends to a constant. It is suggested that the end of useful life for individual valves could best be determined by measuring the anode current or the transconductance with the heater voltage reduced by 10%. Since the Ia/θ curve for valves which have lost emission shows a much reduced saturation effect, this method would show up this defect but would barely affect the test result for valves that were still good.

W.G.Stripp

621.385.1

4314 THE USE OF CERAMICS IN THE CONSTRUCTION OF HIGH-POWER MICROWAVE VALVES. M.Camuzat.

Acta electronica, Vol. 4, No. 1, 59-69 (Jan., 1960). In French.

A brief review of the main points relating to the use of high-alumina ceramics for power valve envelopes. Kovar-type alloys seal easily to alumina, but no details of the technique are included.

A.H.W.Beck

621.385.1 : 537.533

4315 CHARGE LOCALIZATION ON THE SURFACES OF OXIDE-COATED CATHODES.

B.J.Hopkins and F.A.Vick.

Brit. J. appl. Phys., Vol. 11, No. 6, 223-7 (June, 1960).

Anomalous results obtained while using the Kelvin method of determining contact potential differences between oxide-coated cathodes and an evaporated gold film reference surface in an atmosphere of hydrogen have been investigated. Very high contact potential differences have been associated with a separated of charge from ionized gas on the passage of a discharge current. This charge, either positive ions or electrons, remains on the surface of the oxide cathode for periods (sometimes as long as several days) dependent on the conductivity of the oxide coating. This in turn depends upon the nature of the oxide material, its state of activation and its temperature. Experiments are also described on the behaviour of probe cathodes in hydrogen.

621.385.1 : 537.583

4316 THE ROLE OF CHEMICAL REACTIONS IN THERMIONIC EMISSION. G.M.Panchenkov and A.M.Kolchin.

Dokl. Akad. Nauk SSSR, Vol. 131, No. 2, 357-9 (March 11, 1960). In Russian.

On the basis of experiments which are very briefly described it is concluded that, at sufficiently low temperatures and for large concentrations of caesium in thin layers on the emitter, the emission is determined by conversion of caesium atoms as the result of a chemical reaction with the sub-layer and their ionization at the surface.

S.C.Dunn

621.385.1 : 621.315.616.96 : 533.5

4317 EPOXY-RESIN JOINTS FOR SEALED-OFF, HIGH-VACUUM TUBES. J.F.Sayers.

J. sci. Instrum., Vol. 37, No. 6, 203-5 (June, 1960).

Joints may be made in the envelope of sealed-off, high-vacuum tubes using a synthetic resin adhesive, permitting unusual forms of construction. A pressure of 10^{-9} torr may be maintained in such a tube for several years. Success depends on suitable design and processing and on the use of getters. A special television camera tube and a vacuum photocell have been made using this technique.

621.385.1 : 620.16

4318 RELIABILITY OF ELECTRON TUBES IN PRACTICAL APPLICATION. W.Chladek.

Nachrichtentech. Z.(N.T.Z.), Vol. 12, No. 9, 443-9 (Sept., 1959). In German.

The probability of failure, P, and the mean life expectancy $A = 1/P$ for batches of valves are defined. It is pointed out that the incidence of failure tends to be high up to a time t_1 after putting a batch into service, because a proportion of valves have defects due to faulty production. Estimates of t_1 vary but a good approximation is probably 150 hr. Data from various investigations are compared, and from the values obtained, probable times between valve failures for various types of equipment are found. A formula of J.J.Naresky, corrected for the effects of excess heater voltage and ambient temperature, is found to give results in good agreement with those obtained in an investigation by Sylvania into television receiver reliability. After a certain time t_2, failures again become more frequent owing to natural ageing. The value of t_2 is not known, but is certainly greater than 1000 hr.

W.G.Stripp

621.385.1

4319 MATHEMATICAL AND STATISTICAL METHODS APPLIED TO LIFE DATA WITH SPECIAL REFERENCE TO ELECTRON VALVES. A.Deixler and E.Rusch.

Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 12, 613-18 (Dec., 1959). In German.

Discusses Wagemann's remark: "Mathematics is the science of pure number, statistics that of empirical number." Life distributions are discussed in general and then a temporary break-down quota "a" is defined. A Monte-Carlo method model experiment on the statistical dispersion of this quota is described and compared with practical data. Fiducial limits are laid down for the statistical life data of electron tubes.

D.E.Brown

621.385.13.032.22 : 536.2 : 537.533

4320 THERMAL CALCULATIONS FOR ANODES OF ELECTRON TUBES COOLED BY RADIATION IN A VACUUM. V.Ya.Frenkel'.

Zh. tekh. Fiz., Vol. 29, No. 11, 1400-6 (Nov., 1959). In Russian. English translation in: Soviet Physics — Technical Physics (New York), Vol. 4, No. 11, 1290–5 (May, 1960).

Considers the design of plane anodes for vacuum electron tubes. Consideration is given to the radiation of heat from the inner surfaces of the anodes and the thermal shielding due to various structural elements. The formulae and curves which are obtained can be used to determine the dissipation power of an anode for a given geometry and temperature. The method can also be used for designing plane anodes other than those considered in the paper.

621.385.2

4321 THE EFFECT OF SECONDARY AND BACKSCATTERED ELECTRONS IN THE PARALLEL–PLANE DIODE. L.A.Harris.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 413-18 (Oct., 1959).

Separate calculations are carried out to determine the influence

of true, low-energy secondary electrons and of higher-energy back-scattered electrons released from the anode of the parallel-plane, space-charge limited diode. Both groups depress the potential, increase the field near the anode, and decrease the net diode current by small but appreciable amounts.

621.385.2 : 537.533

4322 TRANSPORT OF NOISE AT MICROWAVE FREQUENCIES THROUGH A SPACE-CHARGE-LIMITED DIODE. W.E.Vivian.
J. appl. Phys., Vol. 31, No. 6, 957-62 (June, 1960).

Several analysis of the transport of cathode shot noise through a space-charge-limited diode at microwave frequencies have been published to date. Each of these analysis has been beset by inconsistencies arising from assumptions of monovelocity perturbation flow, direct or reflected. A new method of analysis of diode flow eliminating this problem has been developed. Numerical results based on this method are presented. Attention is restricted to the now classical problem of one-dimensional longitudinal confined flow. The magnitude and variation with distance of the so-called beam noise invariants is shown for a range of diode operating conditions. These calculated results, based for economy on an approximate static flow model, essentially substantiate the qualitive expectations suggested by prior analyses, and fit what little experimental data are available. The method of analysis employed in the calculation of the numerical results comprises a linear multistream formulation, based on representation or approximation of the perturbation particle density for the noise flow as a composite of singular impulse streams, N in number, along characteristic trajectories in the velocity-distance phase space. The set of N coupled first-order linear differential equations resulting is solved by simultaneous numerical extrapolation.

621.385.2 : 537.534

4323 ON THE THEORY OF THE CLOSE-SPACED IMPREGNATED CATHODE THERMIONIC CONVERTER. E.S.Rittner.
J. appl. Phys., Vol. 31, No. 6, 1065-71 (June, 1960).

The tables associated with the exact Langmuir space-charge theory were represented to a maximum relative error of 0.01% by approximation formulae which are suitable for use with digital computers. Application of the exact theory to a thermionic converter comprising two close-spaced planar impregnated cathodes permitted a critical evaluation of the approximate space charge theory of Nottingham (Abstr. 4100 of 1959). The influence of the electrode separation, the emitter and collector work functions and of the emitter temperature was investigated. Spectral emittance measurements on a cathode surface at two wavelength resulted in a more firmly based estimate of the radiation heat transfer between two impregnated cathodes and of the maximum efficiency of an ideal design.

621.385.2

4324 MEASUREMENTS OF ADMITTANCE OF A PLANE-PARALLEL DIODE IN THE TRANSIT-TIME REGION. K.Hennings.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 9, 459-64 (Sept., 1959). In German.

Measurements of the transit-time admittance and transit angle have been made on a specially designed diode with variable electrode spacing using a transmission line at 1.60, 2.42 and 4.0 Gc/s. The results are compared with various theories which apply only over limited ranges of electrode spacing and discrepancies are discussed. C.Fromberg

621.385.3

4325 SUPER-POWER ELECTRON TUBE FOR U.H.F. BAND. G.Flynn.
Electronics, Vol. 33, No. 15, 70-2 (April 8, 1960).

The power amplifier described, designed for high power radar, has a peak-output power of 5 MW at frequencies up to 600 Mc/s and 300 kW continuous output at up to 450 Mc/s. It consists essentially of 96 double-ended triode structures in parallel, all combined into the final tube. The single anode and the grid-wire support-cylinder are water-cooled. The directly-heated thoriated-tungsten cathodes are mounted in an expansion-compensating mechanism. The tube envelope is of ceramic/metal construction. The test circuit and protection circuits are briefly described. The tube is operated with a peak anode-voltage of 35 kV and a peak anode current of 300 A in pulses of from 10 μsec to 2000 μsec. B.Dunford

621.385.3 : 537.533

4326 A GENERAL RELATION AMONG THE PARAMETERS OF MULTI-ELECTRODE VALVES. B.Meltzer.
J. Electronics and Control, Vol. 7, No. 5, 416 (Nov., 1959).

Derives, for a space-charge-limited vacuum device, the relation:

$$R_a^{-1}V_a + g_1V_1 + \ldots + g_nV_n = (3/2)I_a$$

where the g's are the electrode transconductances, and R_a, I_a the anode resistance and current; applies the result to establish a limit on amplification factor possible in a triode. B.Meltzer

621.385.3.029.6

4327 TESTING OF TYPE 2C39 DISK-SEAL TRIODES IN OSCILLATOR CIRCUITS. G.Pusch and H.Schnitger.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 11, 566-72 (Nov., 1959). In German.

Broadcast systems reliability depends to a large extent on valve testing, simple facilities being provided in the field or at stations. An oscillator circuit is described in which the above valve can be readily tested and parameter variations evaluated. This set-up is considerably simpler than previous ones in that measurements are made with fixed-tuned cavities, in the 2 Gc/s region, optimum load matching and feedback. The information available from these measurements, on the other hand, is more comprehensive since all dynamic parameters of importance, including peak valve current, can be assessed. A.Reiss

621.385.3.032.24

4328 CONCERNING THE CALCULATION OF THE THERMAL MODE OF OPERATION OF THE GRID BLOCK OF A RADIO TUBE. V.Ya.Frenkel'.
Zh. tekh. Fiz., Vol. 29, No. 6, 773-7 (June, 1959). In Russian. English translation in: Soviet Physics—Technical Physics (New York), Vol. 4, No. 6, 696-700 (Dec., 1959).

A calculation of the power/temperature relation for a normal grid, wound on thick supports between mica spacers. A.H.W.Beck

621.385.6 : 537.534

4329 SOME SOLUTIONS TO THE EQUATIONS OF STEADY SPACE CHARGE FLOW IN MAGNETIC FIELDS. P.T.Kirstein.
J. Electronics and Control, Vol.,7, No. 5, 417-22 (Nov., 1959).

The equations for steady, laminar space-charge flow are set up. Sets of particular solutions in prescribed magnetic fields are presented — even when the magnetic field has components perpendicular to the cathode. Flows in a large class of magnetic fields from cylindrical and conical cathodes are shown to result, and the existence of similar flows from spiral-sheet cathodes are mentioned.

621.385.6

4330 HISTORY AND PROBLEMS OF MICROWAVE TUBE NOISE. J.R.Whinnery.
Scientia Electrica, Vol. 5, No. 4, 133-50 (Dec., 1959).

Reviews the progress which has been made in the understanding of noise processes in microwave tubes and the various methods which have been used to obtain present low-noise figures. The low-frequency behaviour of noise in electron beams is reviewed and noise reduction by velocity-jump and velocity-tapered guns described. The importance of the low-velocity region of the gun is discussed and miscellaneous complicating effects are listed. 61 references. R.C.Glass

621.385.6 : 621.375.9

MICROWAVE ADLER TUBE. See Abstr. 4251

621.385.623.2

4331 ELEMENTS OF THE THEORY OF AMPLIFIER KLYSTRONS. C.Zlotykamin.
Acta Electronica, Vol. 4, No. 1, 19-46 (Jan., 1960). In French.

A review of the main features of the ballistic theory with some of the modifications introduced by space-charge waves. A.H.W.Beck

621.385.623.3

4332 CONSTRUCTION OF HIGH-POWER, BROAD-BAND KLYSTRONS. C.Zlotykamin.
Acta electronica, Vol. 4, No. 1, 47-57, (Jan., 1960). In French.

Describes glass-metal and ceramic-metal external cavity

klystrons with three and four cavities. It is not possible to determine a consistent set of data for these tubes. A four cavity version gave $\Delta f = 16$ Mc/s at $f_o = 900$ Mc/s when stagger-tuned but how the gain varied is unstated. A.H.W.Beck

621.385.623.4

4333 USING REFLEX KLYSTRONS AS MILLIMETRE-WAVE AMPLIFIERS. K.Ishii.

Electronics, Vol. 33, No. 12, 71-3 (March 18, 1960).

Experimental data on the performance of QK295 reflex klystrons as regenerative amplifiers in the "M" band (50-75 kMc/s) are given. Gains of about 12 dB were achieved. A.H.W.Beck

621.385.623.5

4334 LOW-NOISE KLYSTRON AMPLIFIERS. R.G.Rockwell.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 428-37 (Oct., 1959).

The principles of low-noise guns were applied to klystron amplifiers with good corroboration of the theory. The development described shows that low-noise klystrons are possible. The most obvious difference between guns for low-noise klystrons and those typical of low-noise travelling-wave tubes is the higher beam current which is required for adequate klystron gain. A byproduct of this higher current is a wide dynamic range. In addition to the development of the electrical parameters, a major effort was directed into construction techniques somewhat peculiar to low-noise klystrons. The data taken show that alignment of the low-noise gun electrodes with the drift tube, alignment of the beam with the magnetic field, elimination of the collector's secondary electrons from the beam, and cleanliness of the tube are of primary importance. Several two-cavity, low-noise klystron amplifiers were built for operation in both S- and C-band. The typical low-level gain was 11.5 dB, and the saturated power output was 180 mW. Several tubes exhibited noise figures below 9 dB; the lowest value obtained was 6.7 dB.

621.385.623.5

4335 FERRITE TUNING OF REFLEX KLYSTRONS. P.E.V.Allin.

J. Electronics and Control, Vol. 7, No. 5, 377-92 (Nov., 1959).

Experimental results on the ferrite tuning of the reflex klystrons CV2164 and CV2346 are given and the relation between valve parameters and expected tuning ranges is discussed.

621.385.623.5

4336 AMPLITUDE MODULATION OF THE MICROWAVE ENERGY CONVEYED IN A WAVEGUIDE USING A REFLEX KLYSTRON. R.Métivier, P.Audoin.

Onde elect., Vol. 39, 250-3 (March, 1959). In French.

Admittance studies on a non-oscillating reflex klystron as a function of reflector potential show large admittance variations. A number of Smith-diagram plots are given. An experimental set-up is described in which such an idling klystron is coupled to a waveguide carrying energy from a klystron oscillating at 9050 Mc/s. A dephaser section, placed after the coupling can be adjusted so that admittance varies from 0 to infinity. A sinusoidal voltage on the reflector controls the modulation which is detected and plotted versus control voltage; the resulting plot shows good linearity over most of the possible modulation range. A.Reiss

621.385.623.5 : 621.372.632

4337 HIGH ORDER FREQUENCY MULTIPLICATION USING A REFLEX KLYSTRON. E.N.Bazarov, M.E.Zhabotinskii and E.I.Sverchkov.

Radiotekhnika, Vol. 15, No. 2, 75-9 (Feb., 1960). In Russian.

The theoretical treatment and experimental results are given for high-order frequency-multiplication using a standard reflex klystron. The input signal is introduced into the gap between the reflector and the resonator. The klystron is held in the regenerative mode, self oscillations are stopped by decreasing the voltage on the resonator. The klystron is tuned to the required harmonic. For multiplication by a factor of over thirty, sufficient power (0.5 to 1 milliwatt) was obtained for heterodyning in the three centimetre band. B.Dentskevich

621.385.623.5 : 621.372.632

4338 FREQUENCY CHANGING USING A REFLEX KLYSTRON. E.N.Bazarov and M.E.Zhabotinskii.

Radiotekhnika i Elektronika, Vol. 4, No. 2, 253-61 (Feb., 1960). In Russian.

The possibility of using reflex klystrons as frequency multipliers and dividers at microwave frequencies is shown theoretically. The conditions for achieving this in practice are pointed out and experimental results in agreement with theory are quoted. A special form of reflex klystron having two cavities and three or four grids was constructed for more efficient operation as a frequency changer. [English summary: PB 141106T-13, obtainable from Office of Technical Services, U.S. Dept of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.385.624

4339 SMALL-SIGNAL THEORY OF MULTICAVITY KLYSTRONS. G.R.White.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 449-57 (Oct., 1959).

A small-signal formulation is developed which is valid for multicavity klystrons with nonideal gaps. The complete one-dimensional description of modulation at the gap is given, including the modifications due to space-charge forces. Stagger-tuned amplifiers are treated by matrix and by scalar methods. Equations useful for electronic computation of response are presented. The necessity for the formulation, and its validity, are discussed.

621.385.624.3 : 621.372.632

4340 THREE-CAVITY KLYSTRON FREQUENCY MULTIPLIERS. A.D.Sushrov.

Radiotekhnika i Elektronika, Vol. 4, No. 2, 246-52 (Feb., 1959). In Russian.

Discusses the theory and design of three-resonator klystron frequency multipliers and describes experimental results on klystrons having multiplication factors of 3 and 5 at output frequencies in the 3000 Mc/s region. The three-cavity multiplier has a higher gain than the two-cavity multiplier but because of low efficiency is not suitable for high powers. [English summary: PB141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.385.632.1

4341 ONE-DIMENSIONAL TRAVELING-WAVE TUBE ANALYSES AND THE EFFECT OF RADIAL ELECTRIC FIELD VARIATIONS. J.E.Rowe.

I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 16-22 (Jan., 1960).

The equivalence of the differential-equation and integral-equation approaches to the solution of the nonlinear travelling-wave amplifier problem is shown rigorously. The equations can be transformed one into the other without making any additional assumptions. The space-charge expression developed on the basis of considering the electron distribution in phase space is shown to give the same form for the space-charge weighting function as a space-charge expression based on the electron distribution in space. Efficiency calculations are compared for the two methods and agreement is excellent. Corrections to earlier calculations are included. The effect of radial electric-field variations due to the circuit is considered and it is shown that the efficiency for large streams is reduced in direct proportion to the square of the field reduction function.

621.385.632.3

4342 SPACE-CHARGE WAVE AMPLIFICATION IN AN ELECTRON BEAM MOVING WITH VARIABLE VELOCITY IN CHANNELS IN A LOSSY MEDIUM. Yu.F.Filippov.

Radiotekhnika i Elektronika, Vol. 4, No. 2, 228-32 (Feb., 1959). In Russian.

The effects which occur when a beam of electrons with variable velocity passes through channels in a medium having ohmic losses are investigated theoretically. It is shown that for the special case of an exponential dependence of velocity on distance, growing waves occur. [English summary: PB 141106 T-13 obtainable from office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.385.632.3

4343 CALCULATION OF THE INTERACTION POWER BETWEEN AN ELECTRON BEAM AND THE FIELD OF A SLOW-WAVE STRUCTURE USING AN APPROXIMATION OF THE GIVEN FIELD. V.M.Lopukhin and G.A.Sitnikova.

Radiotekhnika i Elektronika, Vol. 4, No. 2, 218-27 (Feb., 1959). In Russian.

A general solution is obtained for the problem of the interaction of an electron beam and an electromagnetic field of arbitrary form.

The general formulae are applied to the case where the field in the system consists of the sum of n harmonics propagating with various phase velocities and having amplitudes increasing with coordinate. Expressions are obtained for the current density, beam-field interaction power and efficiency. The effect of space-charge is investigated by a method of successive approximations. [English summary PB 141106T-12 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.]. R.C.Glass

621.385.632.3

4344 THE MOTION OF AN ELECTRON BEAM WITH PERIODICALLY VARYING VELOCITY IN CHANNELS IN A LOSSY MEDIUM. Yu.F.Filippov.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 233-40 (Feb., 1959). In Russian.

The motion of an electron beam with periodically varying velocity through a medium with ohmic losses is examined theoretically. It is shown that exponentially-growing waves exist for all values of the beam and medium parameters. The presence of thermal velocities does not lead to the appearance of critical frequencies. [English summary PB 141106T-13 obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington D.C., U.S.A.]. R.C.Glass

621.385.632.3

4345 A TRAVELLING-WAVE TUBE OSCILLATOR WITH AN ELECTRONIC PHASE SHIFTER.
V.P.Tychinskii and V.G.Fedorov.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 241-5 (Feb., 1959). In Russian.

Simplified relationships for the oscillation frequency of a travelling-wave tube with a phase shifter consisting of a drift tube with variable potential between helix sections, and the results of an experimental investigation are given. Several oscillation regions were found. An electronic tuning range of 4% at 3000 Mc/s was obtained, the limitation being the adjacent oscillation modes. [English summary PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.]. R.C.Glass

621.385.633

4346 THE EFFECT OF BEAM CROSS-SECTIONAL VELOCITY VARIATION ON BACKWARD-WAVE-OSCILLATOR CURRENT. N.C.Chang, A.W.Shaw and D.A.Watkins.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 437-42 (Oct., 1959).

Low-voltage helix-type backward-wave oscillators require a starting current that rises to infinity toward the low-frequency end of the tuning range. The effect has been attributed to the raising of the space-charge parameter QC by the d.c. space-charge-induced velocity spread. Johnson (see Abstr. 3828 of 1955) has calculated the velocity-spread effect on starting current qualitatively, but the predicted non-oscillation frequency is generally much lower than the observed one. As a further analysis, space-charge wave propagation in an electron beam having an actual cross-sectional variation of d.c. velocity is investigated. It is shown that the r.f. current modulation in the slow space-charge wave is concentrated in the region of the slowest-moving electrons. In a helix-type backward-wave oscillator using a hollow beam, the slower electrons are farther away from the r.f. circuit, so that the effective impedance for the slow space-charge wave may be considerably reduced. The use of an impedance reduction factor therefore provides better agreement between theory and experiment with regard to the starting-current phenomenon. Theoretical and experimental results of the investigation are presented.

621.385.633

4347 SMALL-SIGNAL ANALYSIS OF THE HELITRON OSCILLATOR. R.H.Pantell.
I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 22-9 (Jan., 1960).

A small-signal analysis of a microwave oscillator discussed by Watkins and Wada (see Abstr. 422 of 1959) is presented. This tube has an electron beam describing the trajectory of a helix between two concentric cylinders. Interaction is with a TEM mode supported on the inner cylinder, and the beam is focused by having a potential difference between the cylinders. This is termed an E-type tube. The E-type tube was originally conceived as a device for exchanging electron potential energy of an electrostatically focused beam for r.f. energy. In this manner, one would expect to obtain the high efficiencies associated with an M-type tube, without requiring a magnetic field. Watkins and Wada presented experimental results which indicated that the theory that had been developed did not predict the observed behaviour. In particular, it was stated that if the propagation constants were those of an M-type tube, the measured starting current would be one-fiftieth of the theoretical starting current. The small-signal analysis of the E-type tube developed in the main body of this paper has yielded two interesting results: (1) the electrons bunch along the direction of rotation, and lose kinetic energy. In this sense the E-type tube behaves similar to the O-type oscillator. Electron motion transverse to the d.c. path, which is important in the M-type tube, is not important for E-type operation. (2) Space-charge forces tend to increase the bunching along the direction of rotation. This results in a negative value for the space-charge parameter, and an attendant reduction in starting current. Growing waves can exist on an electron beam that is electrostatically focused between two conducting cylinders, even without the presence of a circuit field. In this sense the E-type oscillator is similar to the M-type tube.

621.385.633.1

4348 O-TYPE CARCINOTRONS OPERATING AT 2 mm WAVELENGTH. M.Yeou-Ta.
Onde elect., Vol. 39, 789-94 (Oct., 1959). In French.

Experimental carcinotrons are described which furnish up to 5 mW power at frequencies around 150 Gc/s. Some of the test equipment is shown. A discussion of physical and practical limitations and requirements leads to a conclusion that 200 or 250 Gc/s may be aimed at, and 300 Gc/s appears to be a top limit for O-carcinotron operation. A.Sczaniecki

621.385.65

4349 THEORY OF THE AMPLITRON. G.E.Dombrowski.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 419-28 (Oct., 1959).

The Amplitron device is analysed from a normal mode viewpoint based on predominance of the re-entrant character of the stream; the analysis is therefore valid for devices with short electron recirculation times and moderate signal levels. The nature of the space charge deduced from the above hypothesis is that of a rotating set of identical spokes having equal angular spacing in the interaction space. The induction effects of this space-charge configuration upon the delay line are calculated, accounting for the periodic nature and the short length of the delay line. It is found that both forward- and backward-travelling waves are appreciable and must be considered. The fields in the interaction space are resolved into Fourier-component travelling waves. The amplitude of the synchronously interacting wave is related to (1) the input signal; (2) the forward-travelling wave resulting from space-charge induction; and (3) the backward-travelling wave resulting from space-charge induction. Use is made of the phase relation (adiabatic theory) between the space charge and the synchronously travelling wave to obtain a consistent solution determining the phase relation between the input wave and the space charge. The above relationship between the space charge and the input signal allows the calculation of complex (vector) gain of the Amplitron. It is thus shown that the Amplitron is a nonlinear, or saturated, amplifier. A limit to the gain is observed; the backward-travelling wave is essential in determining it. Phase-dependence on operating r.f. level, or r.f. phase pushing, is noted; this type of phase variation does not exceed 90°. Calculations as a function of frequency show the bandwidth to be expected. It is found that conditions may lead to oscillation; feedback mechanisms reside in the backward-travelling wave and in the stream re-entrance. The degree of input mismatch of the operating tube is discussed.

621.385.832

4350 GENERAL INVESTIGATION OF IMAGE TRANSFORMATIONS ON THE SCREEN OF CATHODE-RAY-TUBES, GENERATED BY CONSTANT DEFLECTION-FIELDS.
G.G.Gassman.
Arch. elekt. Übertragung, Vol. 14, No. 2, 71-6 (Feb., 1960). In German.

Presents a formalism, employing the theory of functions of a complex variable, for relating the geometrical transformation of an image in the transverse plane by physically realizable deflecting electric and magnetic fields. (The problem is idealized by considering the deflecting fields as acting sharply only in a single transverse plane). The theory is applied to deflection-angle enlargement for Cartesian coordinates and a conversion of Cartesian to circular coordinates as in the Smith chart. B.Meltzer

621.385.832

4351 THE DESIGN AND PERFORMANCE OF GRID-CONTROLLED, HIGH-PERVEANCE ELECTRON GUNS. H.E.Gallagher.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 390-6 (Oct., 1959).

The focusing electrode and a probe projecting through the cathode serve as control electrodes for the current from a convergent-beam electron gun. The principal advantage of this type of "grid" is that there is no interception of the high-current-density beam by the probe-grid. Design procedures and experimental results for typical probe-gridded guns are given. The design procedure is used to obtain the desired perveance, beam diameter, and approximate laminar electron flow. The probe geometry that results in a minimum beam distortion is discussed. The range of values of amplification factor obtainable and the influence of probe geometry on this factor are discussed. The magnetic field required for focusing the beam is compared with that required for perfect laminar flow and for focusing the beam from a nongridded gun of similar design. An electrolytic tank in conjunction with an analogue computer was used to plot electron trajectories, with the effect of space charge included, for the probe-gridded and a similar nongridded gun. A comparison of the electron optics of the two types is made. Electrical breakdown and beam current during the interpulse time are considered. Methods used to minimize electrical breakdown and interpulse beam current are presented. Several models of probe-gridded guns were constructed and measured characteristics demonstrate that the advantages of grid control can be obtained with only a minor effect on gun perveance and beam focusing.

621.385.832

4352 THE EFFECTS OF INITIAL ELECTRON VELOCITIES AND SPACE CHARGE IN SECONDARY EMISSION. M.D.Hare.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 397-404 (Oct., 1959).

A secondary emitter is treated as a fixed-temperature thermionic emitter with an equivalent work function which depends for its value upon the current density of the incident primary electrons. This permits Langmuir's treatment of the parallel-plane thermionic diode to be applied to secondary emission. The resulting equations account quantitatively for observed secondary-emission effects caused by space charge and initial electron velocities. A discussion is given of three specific electron devices in which secondary-emission effects due to space-charge and initial electron velocity are important.

621.385.833

4353 A THEORETICAL STUDY OF ION PLASMA OSCILLATIONS. W.W.Peterson and H.E.Puthoff.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 372-7 (Oct., 1959).

A theoretical study is made of oscillations in an ion plasma, which is in an electron beam. The effect of ion motion on the electrons is neglected, and the ions and electrons are assumed to have constant and equal density in the equilibrium position. Symmetric and transverse oscillations are studied, both in planar and cylindrical geometry. For planar geometry, the frequency of oscillations for both symmetric and transverse modes is independent of amplitude, while frequency increases with amplitude for cylindrical symmetric oscillations. For both cylindrical and planar geometry, the presence of anode boundaries reduces the frequency for transverse ion oscillations, but does not affect the frequency for symmetric-type oscillations.

621.385.833

4354 ELECTRON BEAM CHARACTERISTICS IN RADIALLY VARYING PERIODIC MAGNETIC FIELDS. C.C.Johnson.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 4, 409-12 (Oct., 1959).

The effect of radial field variation of periodic magnetic field used for light-weight focusing in high-power travelling-wave tubes is investigated analytically as an extension of previous work. The usual design curves of α v. β are plotted with three variable parameters: ripple, cathode shielding parameter K, and radial field variation parameter x_0. It is noted that it is important to keep the magnetic field-strength constant at the beam edge over a considerable variation of the magnetic-field parameter x_0.

621.385.833

4355 TRIODE ELECTRON INJECTION SYSTEMS FOR HOLLOW BEAMS. L.A.Harris.

I.R.E. Trans Electron Devices, Vol. ED-7, No. 1, 46-54 (Jan., 1960).

Novel electron guns, in which a conical hollow electron beam is projected at a large angle to the axis into a coaxial deflection region, were tested. The guns have a triode structure so that the perveance can be varied easily. The strong deflection increases the effective pervance of the beam and makes the trajectories insensitive to current variations. In the form of a device with the gun at a large radius and projecting the beam inward, the electron paths are sensitive to scattering in the gun. The inverted gun, projecting the beam outward, is relatively free from this difficulty. The systems generally behave as expected, and should be quite useful for initiating variable-current hollow electron beams in various available focusing arrangements.

621.385.833

4356 INVESTIGATION OF AN ELECTRON GUN FOR A STRIP BEAM. G.Bolz.

Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 9, 464-6 (Sept., 1959). In German.

Calculates, by series expansions, Pierce electrodes for a convergent strip beam between two coaxial cylinders. On this basis an "optimal" electron gun is designed: discrepancies between its measured and theoretical performance are discussed. B.Meltzer

621.385.833 : 537.533

4357 EXPERIMENTAL ELECTRON MICROSCOPE HAVING A HIGH RESOLVING POWER. A.Delong, V.Drahoš, J.Speciálný and L.Zobač.

Slaboproudy Obzor, Vol. 21, No. 4, 195-206 (1960). In Czech.

A fairly detailed description of the instrument is given (with drawings, diagrams and photographs). It is shown that the theoretical resolution of the microscope operating at accelerating voltages between 30 and 100 kV should be about 4 A. However, in practice the figure is higher due to axial astigmatism, chromatic aberration or the influence of external magnetic fields. The optimum practical resolution of 8 A is obtained at 80 kV with a magnification 120 000. The magnification range of the instrument is 2500 to 180 000. The optical system of the microscope consists of a double condenser lens, an objective, two intermediate lenses and the main projector lens. The accelerating potential is derived from a stabilized h.f., h.v. supply. Ripple and stability of this source are of the order of 10^{-5}. Currents to the lenses are derived from special stabilizers based on the principle of negative dynamic resistance. The ripple and the stability of these devices are about 10^{-4}-10^{-5}. R.S.Sidorowicz

GAS DISCHARGES
GAS-DISCHARGE TUBES

621.387 : 537.52

4358 ELECTRIC ARC WITH GLASS ELECTRODES. I.Mihul and G.Tacu.

Bul. Inst. Politeh. Iasi, Vol. 4(8), No. 3-4, 129-34 (1958). In Roumanian.

Conditions necessary for starting and maintenance of an arc are discussed, for the case of glass or glass/metal electrodes with a.c. or d.c. The experimental set-up is described and c.r.o. photographs of dynamic characteristics are shown and interpreted. 3 references. A.Reiss

621.387 : 621.316.57

4359 THE REIGNITION VOLTAGE CHARACTERISTICS OF FREELY RECOVERING ARCS. F.W.Crawford and H.Edels.

Proc. Instn Elect. Engrs, Paper 3185 S, publ. April, 1960 (Vol. 107A, 202-12).

Advances in the knowledge of arc interruption have been achieved by simplifying the arc and its interuption condition, and studying the recovery of the arc free from the presence of restriking voltage. The arc investigated is a d.c. pulsed discharge of about 100 millisec duration burning freely between carbon electrodes. The reignition voltage of the arc at a given time after sudden interruption is obtained by pulsing with a unit function voltage. By varying the voltage magnitude a 50% reignition value is found, and by repeating at different delay times after interruption, full reignition characteristics have been obtained to an accuracy of within ±5%. Characteristics are given for 10-50 A arcs in air, nitrogen, argon and hydrogen at pressures from

100 to 750 mm Hg, and with gap separations of 1-5 mm. The results show that full recovery takes about 1 sec and that breakdown occurs in different forms. For delays of 0-100 microsec thermal breakdown occurs owing to the low resistivity of the decaying arc column and electrode regions. From about 0.1 to 1 sec true spark breakdown is observed. At intermediate times the breakdown is affected both by free charge and reduced gas density. The spark breakdown voltages are found to follow closely an extended Paschen law, and give useful derived gas temperatures. A new phenomenon of a recovery pause is observed and is explained in terms of breakdown at the minimum spark voltage. The results also show the effects of energy exchange between gas and electrodes, and the improvement of recovery with current reduction and increased electrode mass. Only small differences are observed between the recovery of horizontal and vertical arcs. In general, the rapidity of recovery increases in the following order: argon, air nitrogen and hydrogen.

621.387 : 537.52 : 533.5

4360 MECHANISM OF INERT GAS CLEANUP IN A GASEOUS DISCHARGE. K.B.Blodgett and T.A.Vanderslice.
J. appl. Phys., Vol. 31, No. 6, 1017-23 (June, 1960).

A study was made of the cleanup of inert gases by a gas discharge. The cleanup of rare gases in a tube in which metal is being sputtered is governed largely by two factors. First, the rate at which the metal is sputtered, and second, the potential of the surface on which the metal lands. At small negative or positive potentials on the surface collecting sputtered metal there is a slow cleanup rate caused by uncharged species being buried by sputtered metal. At more negative potentials burial of ions becomes important, and cleanup is much more rapid. Recovery was effected by heating to the evaporation temperatures of the metal. As the metal evaporates the buried gas is liberated. Hundreds of equivalent monolayers of argon were cleaned up with only a total recovery of about one equivalent monolayer by heating at 1500°C. This shows that even with a forced "solubility" of the order of 1% no evidence was found for significant diffusion of argon in metals. An electrode collecting ions at a uniform density over the surface will have a net cleanup rate of zero on that surface after the initial cleanup of a small amount of gas. After the initial disappearance of some gas, resputtering will occur liberating the cleaned up gas as fast as it is being cleaned up.

621.387 : 537.52

4361 STUDY OF THE INFLUENCE OF A MAGNETIC FIELD ON THE INTENSITY OF LINES EMITTED BY SOME DISCHARGE TUBES. O.Tardy and M.R.Lennuier.
J. Phys. Radium, Vol. 19, Suppl. No. 7, 75A-83A (July, 1958). In French.

In fields of several thousands of gauss, an important increase in the intensity of the radiations is observed. The increase is not generally the same for all the lines radiated by a given tube; the electric power consumed by it also increases, but in a lesser ratio, in such a way that the luminous efficiency increases by a factor of about 2.

621.387.424 : 539.1.07

4362 THE PLATEAU SLOPE OF GEIGER COUNTERS WITH ARGON AND ETHYL ALCOHOL.
J.Franeau, F.Grard and R.Libert.
J. Phys. Radium, Vol. 19, Suppl. No. 7, 84A-90A (July, 1958). In French.

An experimental study of the plateau of Geiger counters filled with a mixture of argon and ethyl alcohol shows that the slope remains practically constant beyond a certain partial pressure of argon. Study of the causes of this slope show that at the beginning of the plateau they are due to differences in the height of the pulses; further on, the secondary pulses become an important cause, but these are not sufficient to explain the whole slope.

621.387 : 537.52

4363 THE ROLE OF SPACE CHARGE IN GAS BREAKTHROUGH BETWEEN EQUAL PARALLEL PLANE ELECTRODES BELOW THE PASCHEN PD MINIMUM. H.Ritow.
J. Electronics and Control, Vol. 7, No. 5, 423-38 (Nov., 1959).

Field-emission theory is used to obtain explanations of the left branch of the Paschen curve, the small-gap discharge and its knee characteristics, the "vacuum" discharge and the V_s versus $\sqrt{D}$ law. A possible explanation of the Paschen minimum $P \times D$ is presented. Townsend and "right" side ionization processes are contrasted.

621.387 : 537.52

4364 NEGATIVE CURRENT–VOLTAGE CHARACTERISTICS IN HYDROGEN AT HIGH PRESSURE USING PLANE PARALLEL ELECTRODES.
D.J.DeBitetto, L.H.Fisher and A.L.Ward.
Phys. Rev., Vol. 118, No. 4, 920-3 (May 15, 1960).

In conjunction with measurements of current–voltage characteristics in hydrogen, a few characteristics were obtained which include a region with negative slope. The latter characteristics were obtained with plane parallel electrodes at an electrode separation of 2 cm at a pressure of 400 mm Hg and with three values of externally initiated cathode-current. The initial currents ranged from about 10^{-11} to 10^{-9} A, and the amplified currents reached values as high as 10^{-4} A. The characteristics corresponding to the larger initial currents become negative at large currents ($\sim 10^{-5}$ A). The voltage at which a characteristic becomes negative, i.e. the maximum attainable voltage across the electrodes, decreases slightly with increasing initial current. The circuit included a series resistor of 20 megohms. These characteristics can be explained quantitatively on the basis of the first and second Townsend coefficients (previously measured with the same apparatus) acting in conjunction with space charge, if a not unreasonable discharge area is assumed. These calculations were carried out on an I.B.M. 704 computer.

621.387 : 621.316.722

4365 THE CORONA DISCHARGE AND ITS APPLICATION TO VOLTAGE STABILIZATION. E.Cohen and R.O.Jenkins.
Proc. Instn Elect. Engrs, Paper 3174 E, publ. May, 1960 (Vol. 107 B, 285-94).

The properties of a gas discharge which make it suitable for voltage stabilization are discussed. Various types of corona discharge are described, and it is shown that a corona discharge between a wire anode mounted axially in a cylindrical cathode is the most suitable for voltage stabilization. To obtain the required low impedance it is necessary to use hydrogen as the filling gas. The effect of dimensions on the voltage and impedance of the discharge is discussed, and characteristics of various tubes which have been developed as corona voltage stabilizers covering a range of 350-7000 V are shown. Finally some of the applications of such tubes and their appropriate operating conditions are given.

621.387 : 537.52

4366 SIMILITUDE AND ANODE MATERIAL EFFECTS IN H_2 and D_2 DISCHARGES BELOW THE CRITICAL PRESSURE. G.W.McClure.
J. Electronics and Control, Vol. 7, No. 5, 439-47 (Nov., 1959).

The breakdown potentials of H_2 and D_2 gases were determined below the critical pressure in two discharge tubes of similar shape but of different size in order to ascertain whether or not the initial breakdown conditions conform to Paschen's similarity law. With stainless steel anodes and cathodes, both gases conform extremely well to Paschen's law over a range of pressures yielding starting potentials from 03. to 10 kV. With the same cathodes but with anodes of Pb and Al, small deviations from similarity were observed. It is possible that these deviations are not fundamental, but resulted from deposition of anode material on to the cathode. The present results confirm earlier evidence of a strong dependence of breakdown potential on anode material which occurs only at very low pressure.

ELECTRONIC EQUIPMENT

621.389

4367 COMPONENT-PART SCREENING PROCEDURES BASED ON MULTIPARAMETER MEASUREMENTS. R.E.Thomas.
I.R.E.Trans Compon. Parts, Vol. CP-6, No. 4, 252-8 (Dec., 1959).

A screening methodology base on measurements of several parameters is proposed. The methodology provides an improved semiquantitative basis for the selection and evaluation of screening criteria. The method is devised (1) to yield a minimum number of parameters required for effective screening with a linear function; (2) to determine the gain in reliability obtained by screening on the basis of two parameters rather than one, three rather than two, etc., (3) to determine the parameters which may be interchanged for measurement or cost reasons without changing the effectiveness of

the screening procedure; (4) to determine the probabilities of screening out a superior component and failing to screen out an inferior component; (5) to determine the cost associated with making the screening procedure more stringent; (6) to permit modification of the screening criteria for small changes in component-part design, or lot characteristics; (7) to determine the effect of alternative failure criteria on the screening criteria; and (8) to indicate when practical screening cannot be achieved using a linear function of the parameters selected for measurement. The methodology is based on a combination of standard statistical techniques, and is novel only in maintaining a tractable analysis of the overall problem of screening individual component parts by variables inspection.

621.389

4368 NUCLEAR RADIATION AND ELECTRONIC EQUIPMENT. J.R.Crittenden.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 423-6 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

The processes of nuclear radiation damage are tabulated together with the relative effects on commonly used materials. The effects of radiation on a particular amplifier circuit are analysed and a comparable circuit minimising radiation effects is discussed. It is found that simple circuits with low values of resistance and capacity are most radiation tolerant. A.P.C.Thiele

621.389 : 621.397.62

4369 PRINTED CIRCUIT RELIABILITY AND FLAMMABILITY. D.W.Heightman.

J. Brit. Instn Radio Engrs, Vol. 20, No. 4, 281-2 (April, 1960).

Certain valve or component failures in printed-circuit television receivers can result in rather serious burning of panels. An investigation into the problem is described. A simple method of flux application and dip-soldering is described which has been found to give better reliability than conventional methods.

621.389

4370 COMPONENTS FOR USE WITH PRINTED CIRCUITS. O.Oberrender.

Nachrichtentechnik, Vol. 9, No. 8, 343-6 (Aug., 1959). In German.

Gives requirements for electrical components, such as potentiometers, capacitors, etc., to enable these to be mounted on, and soldered to, standard-grid (German) printed-circuit boards. Suggestions for the re-design and standardization of valve-holders, switches and plug-in connectors for use on these boards are given. The possibilities of design are discussed with reference to the present state of the technique. Photographs show some commercially available components suitable for direct mounting on printed-circuit boards, and soldering up with the solder-bath process. C.J.M.Benard

621.389

4371 PRINTED CIRCUITS. L.Delfosse.

Onde elect., Vol. 40, 183-200 (Feb., 1960). In French.

A comprehensive review. The various types of insulating base material employed are stated and the standard sizes of the formats given. Mechanical and electrical properties of base and conducting material, such as stability and resistivity, are discussed. Manufacturing techniques are described, including design and development procedure and such processes as the use of silk screens, chemical etching. The mounting of detachable components and soldering procedure are also discussed. H.G.M.Spratt

621.389

4372 INSTALLATION OF AN ELECTRONIC INDICATING SYSTEM AT DONISTHORPE COLLIERY. M.B.Smith

Mining elect. mech. Engr, Vol. 40, 329-37 (May, 1960).

Distinctive coloured lights on a panel in a control room at the surface of the mine indicate the open or closed positions of switches below ground. The system consists basically of transmitter units and keying device, coaxial cable, and a cubicle on the surface housing the amplifier, filter units and indicator panel. Each transmitter unit consists of a transistor crystal-oscillator which generates a r.f. signal of a specific frequency, the frequency being governed by a quartz crystal. The power to operate the oscillator is supplied from a battery on the surface via the main coaxial cable, the voltage and current per unit being 4.5 V and 100 μA respectively. The keying device is simply a switch, the closing of which is coincident with the closing of a contactor panel or manually operated circuit-breaker. The galvanized-wire armoured coaxial-cable is the link or conducting medium between the surface filter units and the underground transmitter. The isolator unit, containing transformer and batteries, is used to isolate the surface equipment from the transmitter units in the mine, and to provide the 4.5 V d.c. power source. The cubicle accommodates the power pack, the common amplifiers, gating units and indicating panels. Electronic details of the system are given in an appendix. H.A.Miller

621.389

4373 TRANSISTOR CIRCUIT FOR ENGINE IGNITION. Engineering (London), Vol. 189, 537 (April 15, 1960).

The advantages of a transistorized ignition system (contact-breaker current is reduced by a whole order, and the voltage output remains almost constant with engine speed) are briefly discussed, and the practical equipment is illustrated by a schematic diagram and voltage versus engine speed curves for various ignition systems. A.Landman

MEDICAL ELECTRONICS

621.389 : 681.142

4374 COMPUTERS APPLIED TO BALLISTOCARDIOGRAPHY. S.A.Talbot.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 3, 109-12 (Sept., 1959).

An attempt is made to derive more fundamental data from ballistocardiograms than is given by ordinary recordings. The difficulty of correcting for spurious resonances is aggravated by the fact that the six degrees of freedom of the body (3 translational and 3 rotational) are mutually coupled, and a Reeves computer is used to design a body support whereby these couplings are eliminated. The resulting "true" movements due to the heart are thereby determined, and are illustrated graphically. F.T.Farmer

621.389 : 621.317.321

4375 A NEW SYSTEM FOR ELECTROCARDIOGRAPHIC RECORDING, ANALYSIS AND DIAGNOSIS. J.Martinek, G.C.K.Yeh and R.Carnine.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 3, 112-16 (Sept., 1959).

Instead of recording from three or four points on the body, a large number (up to 100) electrodes are used, and the results are fed into an appropriate multichannel recorder. They are then "compared" automatically by means of an electric cross-correlator with typical heart recordings, including normal. Thus, in spite of the greatly increased complexity of the primary data fed into the system, the interpretation of results is made simpler even than that of ordinary e.c.g. recordings. F.T.Farmer

621.389 : 621.317.79

4376 A NEW STANDARDIZED AND CALIBRATED PHONOCARDIOGRAPHIC SYSTEM. A.A.Luisada and R.Zalter.

I.R.E. Trans. Med. Electronics, Vol. ME-7, No. 1, 15-22 (Jan., 1960).

A phonocardiographic system has been designed and built using standard units of known frequency characteristics. The system is calibrated, as the relative and absolute intensity of the signal can be computed from the records' amplitude, given the conversion factor of the transducer and the degree of amplification in decibels. The system is standardized. It allows the spectrum to be scanned in bands of 1 octave of 3 dB attenuation (therefore ideally flat) with the low-cut-off frequency coinciding with the nominal frequency. A 36 dB per octave attenuation for the high-pass section is suggested for the selective recording of the high-frequency vibration of low intensity. Representative phonocardiographic tracings are presented.

621.389 : 621.317.321

4377 A MULTICHANNEL ANALYZER FOR HEART POTENTIALS. C.V.Nelson, A.F.Wilkinson and L.W.Bowles.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 3, 107-9 (Sept., 1959).

The "equivalent dipole" within the chest can be found by measuring the potentials at a large number of points on the skin. Five contours are taken round the chest and leads from 20 points on each are applied to a high speed scanning commutator. The results are recorded on a magnetic tape and later played back slowly for analysis. The method has been checked by applying to animal hearts suspended in fluid in a cylindrical vessel of simple geometry. F.T.Farmer

621.389 : 681.142

4378 AUTOMATIC READING AND RECORDING OF DIGITAL DATA IN THE ANALYSIS OF PRIMATE BEHAVIOUR. D.McConnell, V.J.Polidora, M.P.Friedman and D.R.Meyer. I.R.E. Trans Med. Electronics, Vol. ME-6, No. 3, 121-5 (Sept., 1959).

The behaviour of rhesus monkeys is studied by a device which provides automatically a stimulus (film strip projection on the two ends of the cage) followed by a reward (in the form of food) and an electrical recording of the time taken for the monkey to respond. The results are coded electrically on punched cards which can go straight into an I.B.M. computer for analysis. F.T.Farmer

621.389 : 621.373.52

4379 A PHYSIOLOGICAL STIMULATOR USING JUNCTION TRANSISTORS. W.T.Catton and L.Molyneux. Electronic Engng, Vol. 32, 301-2 (May, 1960).

This new circuit involves no alterations in the front-panel control arrangements of that described previously (See Abstr. 297 of 1958) provides a better pulse shape and a lower output impedance, with the added advantage of a lower supply battery voltage. The facilities provided are; output voltage variable from 0 to 25 V; frequency variable from 2 to 100/sec; constant pulse-width of about 1msec.

621.389 : 621.373.44

4380 A PULSE POWER AMPLIFIER FOR BIOLOGICAL STIMULATION. H.Ludwig. I.R.E. Trans Med. Electronics, Vol. ME-7, No. 1, 29-31 (Jan., 1960).

A power amplifier designed for use as a biological stimulator is described. It is driven by a d.c. voltage or a pulse generator with an amplitude of 50 V. The output power of up to 250 V and 100 m is precisely controlled. The rise time is less than 5μs. A dual-channel version whose outputs may be independently controlled and mixed is also described. The circuit for the +400 and −300 V regulated power supplies is shown.

621.389 : 621.317.39

4381 BIOLOGICAL FLOW AND PROCESS TRACING USING NUCLEAR AND ELECTRON PARAMAGNETIC RESONANCE. J.R.Singer. I.R.E. Trans Med. Electronics, Vol. ME-7, No. 1, 23-8 (Jan., 1960).

A general discussion of the application of nuclear and electron paramagnetic resonance to determination of blood flow velocities in intact humans is discussed. Feasibility has been proved using mice. The system of measurement essentially utilizes paramagnetic (non-radioactive) tracers. One simple tracing scheme which has been employed experimentally is to saturate the protons in the blood stream and detect the density of these protons as variations occur due to flow. By this means the flow velocity is readily measured. A discussion of paramagnetic resonance theory precedes the discussion of the biological applications.

621.389 : 621.398

4382 BIOMEDICAL MEASURING CIRCUITRY. J.T.Powell. National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 308-20.

The proposed telemetry system is a conventional f.m.–f.m. arrangement requiring voltage inputs to sub-carrier oscillators between 0 and +5 V. The supply voltage available is 28 V with a tolerance of ± 10%. A 5 V d.c. precision supply is also available for small drain requirements. Linear accelerations from 10 to 35 g may be expected as well as vibrations of the order of 10 g r.m.s. or worse. Circuit diagrams, with component values and photographs, are given for the following instrumentation: thermistor thermometers for measuring body temperature (95 to 110° F) and cabin temperature (60-100° F); a respiratory-rate transducer using a very small self-heated thermistor mounted in such a way as to be in the exhaled air stream; a wet-end dry-bulb hygrometer and an arrangement for measuring CO_2 concentration (over a range from 0-7%) by means of the change in thermal conductivity of the gas mixture; a microphone-type stethoscope; an electrocardiograph; an electromyograph; an arrangement for measuring the velocity of propagation of a pulse through the arterial system; an arrangement for measuring the response of the subject to a small electric shock. Among the unsolved problems is mentioned the need for determining the degree of oxygenation in the blood by a simple means. S C.Dunn

621.389 : 621.398

PHYSIOLOGICAL TELEMETRY IN THE SPACE AGE. See Abstr. 3824

621.389 : 621.398

THE REQUIREMENTS FOR BIOMEDICAL MONITORING IN SPACE FLIGHT. See Abstr. 3825

621.389 : 621.317.39

4383 ELECTRONIC TONOMETER FOR GLAUCOMA DIAGNOSIS. R.S.Mackay and E.Marg. Electronics, Vol. 33, No. 7, 115-16 (Feb. 12, 1960).

Intra-ocular pressure is measured by a probe with flat end, containing a small circular plunger 2 mm diam. This plunger, when pressed against the cornea, is held coplanar with the surrounding surface by an electro-servomechanism. The pressure required to maintain this relationship is indicated on a meter, and the result is shown to be independent of the force applied to the probe as a whole over a range of degrees of compression of the eyeball. The movement of the plunger is detected by means of a coil surrounding a ferrite core through which an alternating current is passed. F.T.Farmer

621.389 : 621.317.39

4384 AN IMPROVED RECORDING OXIMETER. A.W.Melville, D.H.Smith and J.B.Cornwall. Electronic Engng, Vol. 32, 296-300 (May, 1960).

An analysis of the theory of ear oximetry is given and an instrument is described which continuously solves the theoretical equation and provides a record of absolute arterial oxygen saturation. The methods previously used for deriving a signal proportional to the logarithm of the intensity of light incident on the earpiece photocells have been found unreliable and have been replaced. The new circuit introduces other advantages, resulting in a high degree of stability and repeatability. The instrument has been developed particularly for use by the anaesthetic staff during prolonged thoracic surgery but it may be employed wherever continuous recording of oxygen saturation is advantageous.

621.389 : 621-52

4385 THE HUMAN BEING AS A LINK IN AN AUTOMATIC CONTROL SYSTEM. I. T.J.Higgins and D.B.Holland. I.R.E. Trans Med. Electronics, Vol. ME-6, No. 3, 125-33 (Sept., 1959).

A critical survey of the literature (71 references) on the mechanics of human control is given. The human being is to be thought of as an element in a control system with his own feedback loop, and certain general principles are derived mathematically which should underlie the design of any system (e.g. the controls of a high-speed aircraft) in which an operator has to react rapidly to any stimulus or combination of stimuli that may be presented. The human operator functions discontinuously: he reduces the "error signal" in stages to zero, though his behaviour may be represented very approximately by a continuously varying function. F.T.Farmer

621.389 : 621.396.96 : 612.843.6

4386 ON THE FACTORS WHICH AFFECT THE PERFORMANCE OF A RADAR OPERATOR. I. F.Mori and L.Ronchi. Atti Fond. Ronchi. Vol. 15, No. 2, 138-51 (March-April, 1960).

The incomplete (either dark of light) adaptation of the periphery is found to affect the speed of reading relative to a foveally viewed test, suprathreshold for both size and illumination. This result should be taken into account by radar operators. It is known that, for avoiding the impairment of visibility, the radar operator must be adapted to the luminance of the screen. An analogous condition is now required if the impairment in speed of reading is to be avoided, even in suprathreshold conditions. The luminance of a radar screen is well defined only in the case of "long memory" tubes and in special environmental conditions, otherwise, the operator is presented with a pulsating stimulus. In this latter case, the speed of reading is found to vary as a function of the frequency of interuption at high and at low levels, respectively, but not at intermediate levels, in the range considered. The trouble observed at higher levels can be minimized by the aid of a light surround. The effects observed are discussed in terms of central interactions.

621.389 : 621-52

4387 PATTERN RECOGNITION AND DISPLAY CHARACTERISTICS. W.R.Bush, R.B.Kelly and V.M.Donahue. I.R.E. Trans Human Factors Electronics, Vol. HFE-1, 11-21 (March, 1960).

Reports experimental results of human operator performance in a visual recognition task. The work began with a method of generating families of complex patterns to simulate certain characteristics of visual sensor displays, such as radar and infrared returns. The

experimental effort was directed toward establishing criteria for predicting human operator performance in a map-matching task. The operators' task was to recognize which of four patterns presented simultaneously with a reference pattern belonged to the reference pattern family. The measure of performance was the time in seconds taken by the operator to make a selection. Response times were more rapid when the reference pattern was less complex than the comparison than when the reference pattern was the more complex. Analysis of the display characteristics led to the selection of four physical measures to be used in predicting operator performance. These measures — pattern length, pattern density, and two measures of pattern complexity — correlated highly with response time, were not highly intercorrelated, and were applicable to natural sensor returns. The four measures were found to account for a high degree of the total variance. Regression equations were derived which predict performance from known values of the four measures.

621.389 : 621.398

4388 PHYSIOLOGICAL TRANSDUCERS FOR MEASUREMENTS IN SPACE VEHICLES.

W.Welkowitz, M.Traite, C.Purpuro and J.Kilduff.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 301-7.

A multichannel physiological measuring system is described which with adaptive circuitry yields 0-10 V output signals for telemetry. Among the devices illustrated and briefly described are: a breathing-rate transducer using strain gauges; a thermometer consisting of a thermister in a housing suitable for taping on to the subject; a commercial electrocardiograph; a ceramic microphone used for measuring heart sounds; galvanic electrodes for measuring skin response; a pneumatic servo system for measuring continuously the systolic blood pressure. S.C.Dunn

621.389

4389 EXPLOSION PREVENTION IN OPERATING THEATRE SUITES. D.Barnett-Salter.

Elect. Times, Vol. 137, 457-9 (March 24, 1960).

American atmospheric conditions require more stringent safety conditions against leakage currents and static electrification than are necessary in the U.K. and called for by the Ministry of Health. A description is given of a U.S. hospital in England where U.S. floor conductive practice was followed, including importing all materials, comprising impervious electrically-conductive tiles laid on conductive mortar. Tests gave an average of 229 kΩ between specified electrodes, and 120 kΩ to earth. M. of H. tests call only for an earth test with a maximum of 2 MΩ dry and 0.1 MΩ wet. Notes on clothing, socket-outlets and lighting are included. E.H.W.Banner

621.389 : 681.142

4390 THE USE OF ELECTRONIC COMPUTERS IN MEDICAL DATA PROCESSING: AIDS IN DIAGNOSIS, CURRENT INFORMATION RETRIEVAL, AND MEDICAL RECORD KEEPING.

R.S.Ledley and L.B.Lusted.

I.R.E. Trans Med. Electronics, Vol. ME-7, No. 1, 31-47 (Jan., 1960).

TELECOMMUNICATION

621.391

4391 NOTE ON UNIQUE DECIPHERABILITY. E.T.Jaynes.

I.R.E. Trans Inform Theory, Vol. IT-5, No. 3, 98-102 (Sept., 1959).

An alphabet of a letters, used under the restrictions: (1) messages uniquely decipherable into words by use of one of the letters as a space mark; and (2) words limited to a maximum length of L letters, is considered. Although imposing these constraints simultaneously may cause a large reduction in the channel capacity of the alphabet, neither by itself causes any reduction. Accordingly, in the absence of constraints other than (1), an inequality of McMillan pertaining to uniquely decipherable messages can be made to be an equality. Defining "semi-optimal" transmission by the condition that the mean transmission time per word is minimized for a given entropy per word, the attainable rate of information transmission under semi-optimal conditions is found. Transmission at full channel capacity is a special case of semi-optimal transmission. Some generalizations and analogies to statistical mechanics are discussed.

621.391

4392 ON THE USE OF LAGUERRE POLYNOMIALS IN TREATING THE ENVELOPE AND PHASE COMPONENTS OF NARROW-BAND GAUSSIAN NOISE. I.S.Reed.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 3, 102-5 (Sept., 1959).

The joint probability density of the envelope of a Gaussian process at two different times is expanded by the use of Hardy's identity into a series involving Laguerre polynomials. It is shown how this result may be used to estimate the cross-correlation function of the output of two quite general envelope-distorting filters. A generalization of this result, involving the use of the associated Laguerre polynomials, is obtained and applied to the calculation of a cross-correlation function which involves both the phase and envelope of the process at two points in time.

621.391

4393 SOME SPECTRAL PROPERTIES OF WEIGHTED RANDOM PROCESSES. H.S.Shapiro and R.A.Silverman.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 3, 123-8 (Sept., 1959).

The power spectrum and, more generally, the spectral covariance of weighted stationary processes is studied. It is found that if the power spectrum of the underlying stationary process is suitably well behaved and properly matched to the weight function, then the high-frequency behaviour of the power spectrum and spectral covariance is especially simple. Asymptotic theorems describing this behaviour precisely are given.

621.391

4394 EXTREMAL CODING FOR SPEECH TRANSMISSION. M.V.Mathews.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 3, 129-36 (Sept., 1959).

A digital coding and its application to speech transmission is described. The coder determines the amplitudes and times of successive extremes (relative maxima and minima) of the signal. This information is decoded at the receiver by interpolating a function between extremes so as to connect them smoothly and preserve the extremes of the original signal in the reconstructed wave. Thus, the coding is a nonlinear sampling technique. It is related to clipped speech encoding which effectively transmits only the times of the extremes. The properties of the coding for speech signals were studied by digital simulation on an I.B.M. 704 computer. Information rate, statistics of the extremes data, and quality of the resulting signal were evaluated. The buffer size necessary to receive the randomly occurring data and transmit at a constant rate was measured.

621.391

4395 A CLASS OF SYSTEMATIC CODES FOR NON-INDEPENDENT ERRORS. N.M.Abramson.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 150-7 (Dec., 1959).

A class of systematic codes has been obtained which will correct all single errors and all double errors which occur in adjacent digits. These codes use significantly fewer checking digits than codes which correct all double errors. In addition, because of inherent regularities in their structure, these codes may be instrumented in a strikingly simple fashion.

621.391

4396 A NOTE ON INVARIANT RELATIONS FOR AMBIGUITY AND DISTANCE FUNCTIONS. C.A.Stutt.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 164-7 (Dec., 1959).

Woodward's result (see Abstr. 1225 of 1954) for the ambiguity function, that the volume associated with its squared magnitude over the time-shift and frequency-shift plane is a constant, has been shown to be true also for a cross-ambiguity function for two time functions. If complex time functions have been obtained by means of a Hilbert transformation from real time functions, it is found for the cross-ambiguity functions that the volumes under the squared real part and under the squared imaginary part are constant and contribute equally to the volume under the squared magnitude function. A "distance" function for two time functions is defined to be the integrated squared difference between these functions. The

relation for the squared real part of the ambiguity function readily yields an invariant relation for the volume associated with this distance function in the case of Hilbert-derived complex time functions. An especially simple invariant relation for the "mean" distance, as computed over the time-shift and frequency-shift plane, exists for such time functions having finite energy and finite mean value.

621.391

4397 ON UPPER BOUNDS FOR ERROR DETECTING AND ERROR CORRECTING CODES OF FINITE LENGTH. N.Wax.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 168-74 (Dec., 1959).

Upper bounds for error detecting and error correcting codes are obtained. One upper bound is found by exploiting the geometrical model of coding introduced by Hamming (see Abstr. 3806 of 1950). The volume of an appropriate geometrical body is compared with the volume of the unit cube, in getting the first upper bound. An improvement on this upper bound can be found by introducing a mass density function, and comparing the mass of the body with the mass of the unit cube. A comparison is made with known upper bounds, and with best codes found thus far. The improved upper bound given is frequently somewhat smaller than previously known upper bounds.

621.391 : 621.372.54

4398 INTERCHANNEL CORRELATION IN A BANK OF PARALLEL FILTERS. J.Galejs and W.Cowan.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 3, 106-14 (Sept., 1959).

The first-order effects of interchannel noise correlation on the fasle alarm and incorrect dismissal probabilities are computed for a bank of parallel RLC filters by expanding the envelope distribution of the n filter outputs in a power series. The correction to the false alarm probability due to noise correlation is found to decrease with increasing threshold-to-r.m.s.-noise ratios. If the filter-separation-to-filter-bandwidth ratios are larger than 0.2, it is less than 15 and 0.2% for threshold-to-r.m.s.-noise ratios exceeding 12 and 14 dB respectively. The correction to the incorrect dismissal probability, which is computed by considering the signal output of three contiguous filters, increases with increasing threshold-to-r.m.s.-noise and signal-to-threshold ratios. Even for filter separations larger than the filter bandwidth, it may be in excess of 100% if the threshold-to-r.m.s.-noise ratio exceeds 12 dB and the signal-to-threshold ratio is larger than 12.

621.391

4399 THE PROBABILITY DENSITY OF THE OUTPUT OF AN RC FILTER WHEN THE INPUT IS A BINARY RANDOM PROCESS. J.A.McFadden.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 174-8 (Dec., 1959).

A new method is given for obtaining the probability density of the output of an RC filter when the input is a stationary binary random process. The axis-crossing intervals of the input are assumed to be statistically independent and identically distributed, but with an arbitrary density function. The method involves a linear integral equation which can be reduced by Laplace transforms. A new family of solutions is given which includes two previously known cases: the random square wave of Poisson type, and the periodic square wave with random time origin. The general result of this family is given in terms of tabulated functions. For other solutions, a recursive technique may be necessary.

621.391 : 621-52

4400 RECURRENT EVENTS IN A BERNOULLI SEQUENCE. M.B.Marcus.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 179-83 (Dec., 1959).

The "point of regeneration" method is used to obtain simple sequential equations for determining the complete probability density function for multiple occurences of events in a Bernoulli sequence. Both the independent and overlapping classes of recurrent events are included in the general framework of these equations. The equations also lead to the generating function for the probability distribution. This is used to obtain the expected recurrence times for the different classes of recurrent events. A distinction is made between the probability distributions for the occurrence of the kth event at the nth trial and the occurrence of k events in n trials. The latter case is of primary concern. The methods employed and the results obtained have extensive applications in problems in automatic control, communications, and information processing.

621.391

4401 DETECTING SIGNALS BY POLARITY COINCIDENCE. B.M.Rosenheck.

Electronics, Vol. 33, No. 5, 67-9 (Jan. 29, 1960).

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H.G.M.Spratt

TELEGRAPH AND TELEPHONE SYSTEMS

621.394.3 : 681.142

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G.A.Montgomerie

621.394.34

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621.395.125

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TELEPHONE EQUIPMENT
COMMUNICATION NETWORKS AND CABLES

621.395.636.1

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621.395.7 : 621.311.6

POWER SUPPLY SYSTEM FOR MANNHEIM'S COMMUNICATION BUILDING. See Abstr. 3960

relation for the squared real part of the ambiguity function readily yields an invariant relation for the volume associated with this distance function in the case of Hilbert-derived complex time functions. An especially simple invariant relation for the "mean" distance, as computed over the time-shift and frequency-shift plane, exists for such time functions having finite energy and finite mean value.

621.391

4397 ON UPPER BOUNDS FOR ERROR DETECTING AND ERROR CORRECTING CODES OF FINITE LENGTH.

N.Wax.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 168-74 (Dec., 1959).

Upper bounds for error detecting and error correcting codes are obtained. One upper bound is found by exploiting the geometrical model of coding introduced by Hamming (see Abstr. 3806 of 1950). The volume of an appropriate geometrical body is compared with the volume of the unit cube, in getting the first upper bound. An improvement on this upper bound can be found by introducing a mass density function, and comparing the mass of the body with the mass of the unit cube. A comparison is made with known upper bounds, and with best codes found thus far. The improved upper bound given is frequently somewhat smaller than previously known upper bounds.

621.391 : 621.372.54

4398 INTERCHANNEL CORRELATION IN A BANK OF PARALLEL FILTERS. J.Galejs and W.Cowan.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 3, 106-14 (Sept., 1959).

The first-order effects of interchannel noise correlation on the fasle alarm and incorrect dismissal probabilities are computed for a bank of parallel RLC filters by expanding the envelope distribution of the n filter outputs in a power series. The correction to the false alarm probability due to noise correlation is found to decrease with increasing threshold-to-r.m.s.-noise ratios. If the filter-separation-to-filter-bandwidth ratios are larger than 0.2, it is less than 15 and 0.2% for threshold-to-r.m.s.-noise ratios exceeding 12 and 14 dB respectively. The correction to the incorrect dismissal probability, which is computed by considering the signal output of three contiguous filters, increases with increasing threshold-to-r.m.s.-noise and signal-to-threshold ratios. Even for filter separations larger than the filter bandwidth, it may be in excess of 100% if the threshold-to-r.m.s.-noise ratio exceeds 12 dB and the signal-to-threshold ratio is larger than 12.

621.391

4399 THE PROBABILITY DENSITY OF THE OUTPUT OF AN RC FILTER WHEN THE INPUT IS A BINARY RANDOM PROCESS. J.A.McFadden.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 174-8 (Dec., 1959).

A new method is given for obtaining the probability density of the output of an RC filter when the input is a stationary binary random process. The axis-crossing intervals of the input are assumed to be statistically independent and identically distributed, but with an arbitrary density function. The method involves a linear integral equation which can be reduced by Laplace transforms. A new family of solutions is given which includes two previously known cases: the random square wave of Poisson type, and the periodic square wave with random time origin. The general result of this family is given in terms of tabulated functions. For other solutions, a recursive technique may be necessary.

621.391 : 621-52

4400 RECURRENT EVENTS IN A BERNOULLI SEQUENCE. M.B.Marcus.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 179-83 (Dec., 1959).

The "point of regeneration" method is used to obtain simple sequential equations for determining the complete probability density function for multiple occurences of events in a Bernoulli sequence. Both the independent and overlapping classes of recurrent events are included in the general framework of these equations. The equations also lead to the generating function for the probability distribution. This is used to obtain the expected recurrence times for the different classes of recurrent events. A distinction is made between the probability distributions for the occurrence of the kth event at the nth trial and the occurrence of k events in n trials. The latter case is of primary concern. The methods employed and the results obtained have extensive applications in problems in automatic control, communications, and information processing.

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621.395.7 : 621.311.6

POWER SUPPLY SYSTEM FOR MANNHEIM'S COMMUNICATION BUILDING. See Abstr. 3960

621.395.724

4412 A NEW DYNAMIC IMPEDANCE MATCHING CIRCUIT AS APPLIED TO A CONFERENCE REPEATER. O.D.Grandstaff.
Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 751-5 (1960) = Commun. and Electronics No. 46 (Jan., 1960).

Conference telephone circuits involving an indefinite number of parties pose problems in impedance matching as well as of actual power requirements when the number of listeners may be large. The latter problem is readily resolved by use of an amplifier, but matching demands both-way matching when at any moment a source may become a receiver, and vice-versa. The problem is solved in general by the provision of an additional generator (source) in parallel with all the loads (receivers) on the first source, the additional generator serving to maintain the "matched" voltage on the loads which would obtain in the case of a 2-party connection. In the arrangement described, the additional generator consists of an amplifier with cathode-follower output to provide a source of negligible impedance, and the circuit includes a new method of detecting direction of power flow which does not require a balancing network. A conference repeater unit using hard valves for six lines is illustrated, but the arrangements described are suitable for up to twelve lines, and curves are included showing the favourable impedance and voltage relationships which obtain, using these arrangements, together with curves of frequency response. W.J.Mitchell

621.395.724

4413 A TRANSISTORIZED PULSE CODE REPEATER. G.R.Partridge.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 826-30 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A description is given of a transistorized repeater used in the transmission of pulse-code modulation by cable. The repeater is one component of a complete communications system developed for the simultaneous transmission of 24 telephone conversations on military spiral-four cable. The repeaters are spaced at one mile intervals, consume 400 mW each and are capable of operating at a baud rate of 1152 kc/s. over the temperature range from - 55°C to to + 65°C. H.L.Nattrass

621.395.74

4414 GLOBAL PUBLIC TELEPHONE SERVICE - 1958. D.D.Donald and T.A.Chandler.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 811-17 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

Reviews the growth of the overseas public telephone service (with respect to the U.S.) since 1953, and shows that, with the introduction of transoceanic telephone cables for services for which radio has in the past been mainly responsible, there has been an opposing trend toward using radio for domestic networks and short links to near-by islands. The expanding use of line-of-sight and over-the-horizon radio systems is clearly evident, providing circuits in quality and quantity comparable to those provided by wire methods, but h. f. ionospheric reflection radio continues to be a major method of transoceanic communications. These trends have developed a need for improved operating methods, including long-distance signalling and dialling, and the frequency-diversity system to Hawaii, using tones at 800 and 1900 c/s, with frequency-shift keying (200 c/s upward) is specifically mentioned. The Bell Laboratories T.A.S.I. system for increasing channel capacity on submarine cables by better utilisation of channel time is also referred to. A map of the Bell System Overseas Telephone Service is included. W.J.Mitchell

ELECTROACOUSTIC APPARATUS

621.395.62

4415 HIGH-POWERED AUDIO ALARM SYSTEMS. W.F.Ferguson.
Electronics, Vol. 33, No. 16, 70-2 (April 15, 1960).

This system is designed to replace the conventional siren warning system and at the same time provide facilities for voice communication. The siren note is simulated by two blocking oscillators acting as tone generators and driven from a multivibrator. The output from the tone generators passes to a 3-stage preamplifier and a line driver stage. The latter is used to feed, via radio units or telephone lines, remote high-power stations each delivering 200 W to four loudspeakers arranged in space quadrature. Each station covers a circle of about ½ mile diameter. Coding circuits which gate the audio output on and off are provided to alert individual zones. The whole equipment is transistorized. H.G.M.Spratt

621.395.62

4416 CIRCUITS FOR THREE-CHANNEL STEREOPHONIC PLAYBACK DERIVED FROM TWO SOUND TRACKS. P.W.Klipsch
I.R.E. Trans Audio, Vol. AU-7, No. 6, 161-5 (Nov.-Dec., 1959).

Derivation of a third playback channel from two stereo sound tracks may be accomplished by several means. The centre channel may be derived by recombination prior to power amplification; acoustically, after amplification, by using two centre speakers; and in a variety of phase relationships, including the limiting case of equal signals (monophonic) in which either sum or difference combination may be chosen by polarity selection.

621.395.623.7

4417 A STUDY OF THE MECHANICAL DAMPING OF DYNAMIC LOUDSPEAKERS BY MEANS OF POROUS MATERIAL. L.Keibs.
Tech. Mitt. BRF, Vol. 3, No. 1-2, 7-12 (Oct., 1959). In German.

Irregularities in the response of loudspeaker cones are discussed and the conventional methods of control are reviewed. These include magnetic damping, viscous materials on centering spiders or cone rims, internal damping in the cone material and the use of feedback control in conjunction with the driving amplifier. It is said to be difficult to maintain optimum damping by these methods. Damping by means of a porous foam material acoustically coupled to the cone is discussed. The effects are said to be calculable for low frequencies and a mathematical analysis is given. Curves are derived which enable the correct amount of a given porous material to be determined. It is usually applied over the openings in the cone bucket. Figures taken from commercial samples are given. M.L.Gayford

621.395.625.2

4418 THE PYRAMID STYLUS. C.D.O'Neal.
I.R.E. Trans Audio, Vol. AU-7, No. 6, 140-7 (Nov.-Dec., 1959).

A new shape for a phonograph needle stylus is described which greatly improves the reproduction possibilities from phonograph records. The new stylus was specifically produced for use with 45°–45° stereo recordings, but will perform equally well on all microgrooved monaural recordings. The scheme described evolves a shape of reproducing stylus having a basic geometry relating to the cutting stylus used in forming all microgrooves. Computations, experimental data and charts are also used to support the improvements to be expected in reproduction performance.

621.395.625.3 : 621.397.6

4419 A TRANSPORT MECHANISM DESIGN FOR THE TELEVISION-TAPE RECORDER. J.G.Lee.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 2, 98-101 (Feb., 1960).

The transport mechanism is incorporated in the centre panel of a 3-rack unit. 2 in.-wide tape running at 15 in./sec is employed. The four transverse scanning heads are carried on a wheel running at 240 rev/min. The shoe through which the tape passes at the scanning point is provided with an air vacuum to hold the tape in position. A master erase head is located before the video-scanning assembly and control, audio, cue and monitoring heads after it. The mechanical design is described in detail, particularly the means of adjusting shoe pressure to avoid discontinuities or "off-sets" in the received picture. H.G.M.Spratt

621.395.625.3 : 621.317.34

4420 A SUGGESTED METHOD FOR MEASURING TAPE MODULATION NOISE. J.J.Davidson.
J. Audio Engng Soc., Vol. 8, No. 1, 23-8 (Jan., 1960).

The accepted methods are deprecated as being indirect. The suggested method consists in recording identical signals on two parallel tracks. On playback, one signal is subtracted from the other and since the signals are, in theory, identical while associated noise components are different, the result will be a noise signal only. To obtain 60 dB of cancellation of the recorded signal, the tape skew, which is responsible for relative phase shift, must not exceed 0.05 deg. This is impossible to achieve mechanically and two electrical methods are proposed for overcoming the difficulty:

(1) to effect instantaneous phase correction using a phase demodulator; and (2) to detect synchronously the residual signal after subtraction against a carrier derived from the sum of the two signals, so giving a d.c. output proportional to the noise. This method is, however, an indirect one also. H.G.M.Spratt

621.395.625.3

4421 PROPERTIES OF BASE MATERIALS USED FOR THE MANUFACTURE OF MAGNETIC RECORDING TAPE. E.Schmidt.
J. Audio Engng Soc., Vol. 8, No. 1, 52-7 (Jan., 1960).

A review of the relative properties of diacetate, triacetate and polyethylene (terylene or mylar) film bases. The lower plasticizer and solvent content of triacetate, as compared with diacetate film, tends to give greater dimensional stability and less embrittlement with time. The superiority of mylar film over all acetate films is due to its being a chemical entity whereas cellulose acetate is a 3-part chemical mixture. Mylar film is mechanically stronger and shows no sign of deterioration with age. It is, however, more expensive and the wastage during tape manufacture is undesirably high. The fact that under high tensile stress it stretches long before tearing is also disadvantageous under certain conditions of use. The development of a tensilized mylar product with higher tensile strength but greater sensitivity to high temperatures is discussed. H.G.M.Spratt

621.395.625.3

4422 THE TRANSPORT MECHANISM OF THE REPORTER MAGNETIC RECORDER [TYPE R20]. O.W.Meier.
Tech. Mitt. BRF, Vol. 3, No. 1-2, 12-21 (Oct., 1959). In German.

The cardinal features for a battery-driven portable machine, tape speed, track width and tape length, are considered. Similarly, the various forms of tape drive, driving motor requirements, bearings and current loading are discussed. The R20 operates at $3\frac{3}{4}$ in/sec, single track, and embodies facilities for playback but has no loudspeaker. A comparison table gives specification figures for it and eight other similar machines, German, Austrian, Russian and Swiss. H.G.M.Spratt

RADIOCOMMUNICATION

621.396.2 : 621.396.65

4423 POSSIBILITIES FOR THE USE OF TRANSISTORS IN RADIO LINKS. C.Tamburello.
Alta Frequenza, Vol. 28, No. 3-4, 285-313 (June-Aug., 1959). In Italian.

After a review of the characteristics of various types of junction transistor, some amplifier and oscillator circuits are given. Although it is usual to employ valves for certain h.f. and power stages, an examination of the requirements shows that transistors capable of performing all the functions necessary are already available if a modest power output is sufficient and a fairly low intermediate-frequency is chosen. A bibliography of 61 items is given. W.G.Stripp

621.396.2 : 621.396.65

4424 THE CHOICE OF FREQUENCIES FOR RADIO LINKS. G.Pivetta.
Alta Frequenza, Vol. 28, No. 3-4, 370-82 (June-Aug., 1959). In Italian.

Minimum frequencies are tabulated in terms of bandwidth per channel and number of channels. The effects of path attenuation, distortion and fading due to multiple path transmission, and intermodulation are studied in relation to frequency. W.G.Stripp

621.396.2 : 621.396.65

4425 FREQUENCY PATTERNS FOR MULTIPLE-RADIO-CHANNEL ROUTES. B.B.Jacobsen.
Proc. Instn Elect. Engrs, Paper 3033 E, publ. Nov., 1959 (Vol. 107B, 241-9, 249-52).

Republication, with discussion, of the paper already abstracted as Abstr. 7546 of 1959.

621.396.2 : 621.396.65

4426 INTERFERENCE BETWEEN FREQUENCY-MODULATED RADIO LINKS. M.Federici.
Alta Frequenza, Vol. 28, No. 3-4, 383-93 (June-Aug., 1959). In Italian.

Expressions for signal/noise ratio are derived for unmodulated wanted and interfering signals, for an unmodulated wave and a modulated interfering signal, for the reverse case, and for the case where both signals are modulated. It is shown that the interference may be greater than for amplitude modulation, and that modulation of either the wanted or interfering carrier improves the signal/noise ratio because the interference spectrum is spread over all channels. The interference is least when both carriers are frequency-modulated. W.G.Stripp

621.396.2

4427 DEVELOPMENT TRENDS IN U.S.A.F. GLOBAL COMMUNICATIONS SYSTEMS. C.A.Strom, Jr and A.A.Kunze.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 241-8 (Dec., 1959).

Briefly summarizes one initial development approach for the 1962-1965 U.S.A.F. Global Communications Systems. A brief review is given of some of the early communications systems work and the present design philosophy for the 600 voice bandwidth channel, 6000 mile trunk system is discussed. Specific requirements of the ground-based Air Force common-user system are listed and developments intended to provide much of the equipment for this time period are noted.

621.396.2 : 621.396.65

4428 RADIO LINKS WITH TRAVELLING-WAVE TUBES. L.Barbaglio.
Alta Frequenza, Vol. 28, No. 3-4, 339-55 (June-Aug., 1959). In Italian.

Schematic diagrams of a terminal station and a repeater station operating in the band 1750-2300 Mc/s are given. At terminal stations the multiplex signals frequency-modulate a carrier, which is then multiplied to the microwave frequency. At repeaters, the received signal is amplified by a low-noise travelling wave tube, followed by an intermediate-power t.w.t. Double mixing gives a retransmission frequency 213 Mc/s distant from the received frequency. The use of travelling-wave tubes eliminates the need to convert to an intermediate frequency for amplification, with the consequent phase distortion. Details of remote checking and alarm circuits are also given. W.G.Stripp

621.396.2

4429 TELECOMMUNICATIONS USING TROPOSPHERIC PROPAGATION. C.Ducot, G.Andrieux and J.Cayzac.
Acta electronica, Vol. 4, No. 1, 97-114 (Jan., 1960). In French.

A tropospheric scatter link between Paris and Caen working on 900 Mc/s is described. 30 telephone channels are provided, with a base band of 4-143 kc/s. A 1.5 kW klystron amplifier provides the output power. Methods of improving the system are discussed. A.H.W.Beck

621.396.2 : 621.396.65

4430 TROPOSPHERIC RADIO LINKS. A.Favilli.
Alta Frequenza, Vol. 28, No. 3-4, 356-69 (June-Aug., 1959). In Italian.

The phenomena of propagation by tropospheric diffraction are discussed and the equipment for two systems working in the ranges 750-1000 Mc/s and 1000-2400 Mc/s is described, with block diagrams. W.G.Stripp

621.396.2 : 621.396.65

4431 TROPOSPHERIC - SCATTER (COMMUNICATION) LINK PRAGUE–BERLIN AT 1.2 Gc/s. U.Kühn and P.Beckmann.
Slaboproudy Obzor, Vol. 21, No. 3, 131-4 (1960). In Czech.

This experimental link is designed to study diurnal and yearly variations of tropospheric-scatter propagation, the relative time during which the received signal falls below a given level and the effect of the atmospheric conditions. The transmitter, which is continuously modulated by a constant audio signal and operates 24 hr per day, has an output power of 50W and is situated in Prague. The receiver also operates continously. Both transmitter and receiver are furnished with parabolic aerials having a diameter of 4 m, a gain of 30dB and a beam width of 3.5°. Preliminary measurements showed that the received signal fluctuates between 1 and 50 μV. The difference between received signal levels during day and night is comparatively small. R.S.Sidorowicz

621.396.2

4432 TROPOSPHERIC-DIFFUSION RADIO-TELEPHONY EQUIPMENT. G.Andrieux, J.Cayzac and C.Ducot.
Onde élect., Vol. 40, 74-81 (Jan., 1960). In French.

A description of an experimental one-way 30-channel system operating between Paris and Caen on a frequency of 900 Mc/s. The transmitter has an output power of 1.5 kW, the power amplifier using a 3-cavity klystron developed by L.E.P. (Laboratoires d'Electronique et de Physique Appliquée). The carrier wave is frequency-modulated in a phase-corrected modulator with 5 tripler stages. The receivers use the EC157 tube as u.h.f. preamplifier, double space-diversity being effected by a combiner produced by Télécommunications Radioélectriques et Téléphoniques. With aerials 5 m in diameter the mean fluctuation noise on the 204 km Paris–Caen link was –40 dB in the most unfavourable channel. Intermodulation noise with normal loading of the system was in the region of –53 dB. A.Wilkinson

621.396.2 : 621.396.65

4433 A STUDY OF THE TECHNICAL AND ECONOMIC FEASIBILITY FOR TROPOSPHERIC SCATTER CIRCUITS IN PRIMARY TOLL NETWORKS OF UNDERDEVELOPED COUNTRIES. C.A.Parry.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 290-5 (Dec., 1959).

The inherent capabilities of the tropospheric scatter circuit have emphasized the need for careful economic and technical evaluation. It is suggested that this should be carried out in two phases. The first is a broad study which determines the essential system parameters for which detailed analysis is necessary. The second phase is concerned with this detail. Outlines are given relevant to the principal factors associated with the first of these phases. These cover such areas as trunk circuit growth, required channel capacity at the end of the amortization period, revenue potential, optimum routing, choice of transmission method, and the optimum number of tandem tropospheric scatter links. The performance sacrifice for a minimal cost "first in" system and the manner in which design accuracy may be traded against probable propagation reliability are two of the problems discussed. Evaluation of the scatter link may be based on a performance index and data relevant to this are given.

621.396.2 : 621.398

4434 PARAMETERS AND TECHNIQUES APPLICABLE TO ULTRA-LONG-RANGE COMMUNICATION WITH SOLAR SYSTEM PROBES. J.J.Downing.
National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 331-42.

A number of conclusions are reached. The receiving aerial should be a paraboloidal reflector constructed with a profile accuracy no worse than $\lambda/16$. With such a tolerance the loss in gain should not exceed 0.25 dB. At observation angles considerably below the celestial zenith, multipath fading similar to that encountered in scatter communications occurs; this places an upper limit to the receiver aerial gain which may be reasonably expected yielding perhaps 50-60 dB. Combining the trends exhibited by galactic radio noise and atmospheric absorption the choice of operating frequency would appear to lie between 1 and 2 Gc/s. No particular choice of receiver configuration is made, hope being pinned on the future development of maser techniques. The choice of detection circuit lies between a synchronous demodulator for a.m. and a phase-lock loop for f.m. The most favourable power supply is one deriving energy from solar radiation but fuel cells or even a small electronuclear generator may be preferable. The fundamental shortcoming of thermionic tubes is the heater-power requirement, but the development of the self-sustaining emission cathode would appear to offer great promise. Full cathode activity may be maintained at the expenditure of only a few milliwatts. The favoured choice for the final stage is a "floating-drift-tube". An assessment of the component performance suggests that between earth and Mars it should be possible to establish a link with an information bandwidth of almost 1 kc/s. It is concluded that a space-repeater-chain would be of no advantage whatever. S.C.Dunn

621.396.2

4435 RADIO BEAM EQUIPMENTS FOR THE 3800-4200 Mc/s BAND. J.Dascotte.
Onde elect., Vol. 39, 769-84 (Oct., 1959). In French.

A new beam system is in course of installation between the P.T.T. tower at Loos, near Lille, and Folkestone, England, with repeater stations at Cassel and at Fiennes, some distance from Calais. This system will at first comprise 2 channels for 819-line television, or other definitions, and 2 channels intended for 600 telephony channels each. These 4 channels will ultimately be increased to 6 and the equipment required for this extension is already provided. The equipment for the television channels and the supervision link is supplied by the French Société Le Matériel Téléphonique, while the equipment for the telephony channels, the aerials and the branching filters will be supplied by the Standard Telephone and Cable Co., England. The present paper is limited to a description of the L.M.T. radio beam equipment which has just been installed for television. A description of the aerial systems, filters and telephony equipment will be published after these have been received. Measures adopted to simplify the construction of the television equipment and to ensure efficiency of operation are briefly discussed and a detailed description is given of the basic transmitter-receiver equipment LMT402961, the operation and special features of the various units being fully explained. The electrical characteristics of the whole system are also discussed. A.Wilkinson

621.396.2

4436 THE FLAGSTAFF–PHOENIX TJ RADIO SYSTEM. J.W.Hidy.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 821-6 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A description is given of the layout and some of the special engineering features of the Flagstaff–Phoenix TJ radio relay system. A comparison is drawn between the Western Electric TD-2 and TJ systems and reasons are given for the choice of the TJ system. Because the system is small and packaged, prefabricated buildings were temporarily located at a central point where the equipment was installed. After tests each repeater was moved to its permanent location. The method appears economically feasible and it is suggested that similar arrangements may be applied to other projects. H.L.Nattrass

621.396.2

4437 THE MEDEA-LAGHOUAT-OUARGLA RADIO LINK. M.Olivier and J.Pellerin.
Onde élect., Vol. 40, 32-8 (Jan., 1960). In French.

Describes the general and special features of a system in Algeria with a total length of 604 km. Two relay stations are used between Medea and Laghouat. The equipment used is the TH949T equipment of the Compagnie Française Thomson-Houston, which is a modification of the TH949 set previously described (See Abstr. 2211 of 1958). Operation is at 450 Mc/s and the 10 m paraboloid aerials are mounted on autostable pylons. Details are given of the special measures adopted to ensure reliable working. A.Wilkinson

621.396.2

4438 TRANSHORIZON RADIO LINKS IN THE RANGE 4400-5000 Mc/s. J.Dockes and W.Koreicho.
Onde élect., Vol. 40, 100-5 (Jan., 1960). In French.

The general data available for determining the characteristics of a troposhperic-diffusion transhorizon radio link system operating at a frequency near 4500 Mc/s are discussed, with particular reference to the mean attenuation over each section of the link, diurnal and seasonal variations of the level of the received signal, and the transmission bandwidth required. A short general description, with block diagram, is then given of the equipment for a f.m. link operating in the frequency band 4400-5000 Mc/s. The power amplifier uses a 4-cavity klystron giving a 1 kW output. The receivers are of classic type with two frequency changes and are used in quadruple diversity. The aerial dimensions depend on the length of the links to be established. For transportable equipment providing 60 telephony channels between stations 150 km apart, parabolic reflectors 4.5 m in diameter would give satisfactory results. A.Wilkinson

621.396.2

4439 TRANSHORIZON RADIO LINK EQUIPMENT FOR THE 170 Mc/s BAND. R.Bayot and A.Forest.
Onde élect., Vol. 40, 65-73 (Jan., 1960). In French.

The type HF 650 equipment operates in the frequency band 148-174 Mc/s with a transmitter output power of 1 kW and provides a maximum of 36 telephony channels. Phase modulation is used in the transmitter. Double-diversity reception by receivers of low noise factor has proved satisfactory. A description is given of the equipment of two links, one for communications in Madagascar, the other connecting Constantine with Hassi Messaoud, Algeria. Block diagrams show the essential features of the various units. The aerials consist of a network of dipoles formed by 8 reflectors each supporting 4 $\lambda/2$ dipoles. Performance figures are given and the operating routine is outlined. A.Wilkinson

621.396.2

4440 PROTOTYPE TRANSHORIZON RADIO-LINK EQUIPMENT FOR THE 2000 Mc/s BAND.

I. A PROTOTYPE RADIO-LINK EQUIPMENT FOR THE 2000 Mc/s BAND. G.Broussaud and L.Malnar.

II. A DESCRIPTION OF A 10 kW PROTOTYPE AMPLIFIER FOR THE 2000 Mc/s BAND. R.Baud.

Onde elect., Vol. 40, 82, 83-95, 96-99 (Jan., 1960). In French.

In two parts, with a short introduction by F.du Castel. Part I, by Broussaud and Malnar, describes the various units of the transmitting and receiving equipment. The transmitter output power is 10 kW and the available frequency band extends from 2100 to 2400 Mc/s. Frequency modulation is used and 36 telephony channels are provided. The parabolic reflectors of the aerials are 12 m in diameter and frequency diversity is used in reception. Block diagrams show the main units of the transmitter and receiver. The special features of particularly interesting units, such as the polarization duplexer, certain waveguide sections, the noise filter and the harmonic rejector, are shown in sectional diagrams and photographs. Part II, by Baud, describes the construction of the power amplifier, in which the use of the TH 2800/VA800C 4-cavity klystron enables the output power to be increased from a few watts to 10 kW in a single stage of amplification. Details are given of the coaxial input connections and waveguide output arrangements, also of the power supply and cooling systems for the klystron, whose construction and working are explained. A.Wilkinson

621.396.2

4441 NORWEGIAN DEFENCE RADIO LINK SYSTEM. K.Martinsen.

Tekn. Ukeblad, Vol. 107, No. 13, 263-7 (March 31, 1960). In Norwegian.

This system, financed by Nato, is now complete. It comprises 15 individual links, and has a present capacity of 200 000 channel-kilometres which will subsequently be increased to 300 000. 24-channel equipment is installed for the 3000 Mc/s band and 60-channel for the 4000 Mc/s band. All relay stations are provided with 100% standby equipment. Alarm systems indicate transmitter, receiver and power supply faults. Maintenance and repair facilities are discussed. Fault statistics are shown for the period 1 Jan. - 30 Nov. 1959. Experience has shown that 99% reliability can be expected for radio links with up to 10 relay stations. G.N.J.Beck

621.396.2

4442 MICROWAVE SYSTEMS ON THE PACIFIC GREAT EASTERN RAILWAY. R.N.Doble and J.E.Raftis.

Trans Amer. Inst. Elect. Engrs I, Vol. 78, 800-6 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A brief history of the development of the microwave system is given together with a description of the equipment used and its traffic capacity. The microwave equipment is of Motorola design and operates in the 6000 Mc/s band. The average microwave path length is 25 miles and the longest 60 miles. As many as three passive repeaters may be employed in one link.

H.L.Nattrass

621.396.2 : 621.306.65

4443 MICROWAVES AND THEIR USE IN POWER SYSTEMS. S.C.Bartlett.

Trans Amer. Inst. Elect. Engrs I, Vol. 78, 1095-1106 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A detailed discussion is presented regarding the adoption of microwave communication between points distributed within the American Electric Power system. Comparisons are drawn between existing methods of communication and relative cost figures are given. It is shown that microwave systems entail the least annual cost when the channel capacity exceeds about eight. A description is given of the existing A.E.P. microwave installations and performance figures are given for certain sections. Future expansion is considered and the general conclusion is drawn that microwave systems should be given serious consideration in this respect.

H.L.Nattrass

621.396.2

4444 POWER TRANSMISSION VIA RADIO WAVES. R.W.Bickmore.

Proc. Inst. Radio Engrs, Vol. 48, No. 3, 366-7 (March, 1960).

The current revival of interest in high-power radio-links has raised the question of the optimum aerial system which can be designed. The letter indicates a design criterion which optimizes the design, whilst paying due regard to the cost involved. The results of the theory of coupled aerials, adapted to the problem, are presented. The final conclusion is that to transfer power between two points by means of radio waves, as distinct from the use of a direct transmission line, is not economical if one considers only the cost of the transmission line. A.C.Brown

TRANSMITTERS . RECEIVERS

621.396.61 : 621.398

R.F. MULTIPLEXING OF TELEMETRY TRANSMITTERS. See Abstr. 3843

621.396.621.54 : 621.396

DOUBLE SUPERHET. RECEIVER FOR 2200 Mc/s TELEMETRY. See Abstr. 3841

621.396.65 : 621.335.3

DISTURBANCE OF RADIO TELEPHONY ON COLLIERY LOCOMOTIVES AND PROTECTIVE MEASURES. See Abstr. 4049

RADIOFREQUENCY EQUIPMENT

621.396.662 : 621.397.62

4445 TRANSISTORIZED TUNERS FOR PORTABLE TELEVISION. Y.Mukai and P.V.Simpson.

Electronics, Vol. 33, No. 12, 76-8 (March 18, 1960).

A brief engineering description of a miniaturized incremental TV tuner employing three micro-alloy diffused p-n-p germanium transistors in r.f., oscillator and freq. changer stages. Performance characteristics such as gain, noise factor and oscillator drift with supply voltage are plotted and shown to be of the same order as conventional valve tuners. Specific problems of a.g.c., overload and cross-modulation are also discussed, and relevant optimal circuit arrangements are indicated. A Landman

621.396.666

4446 A DIVERSITY COMBINER FOR TRANSHORIZON LINKS. P.Lemoine.

Onde elect., Vol. 40, 112-15 (Jan., 1960).

The various factors to be considered in choosing the best type of diversity receiving system for a radio link subject to random fluctuations are discussed and a short description is given, with a block diagram showing the various units, of the diversity system adopted by the Compagni Générale d' Electricité for tropospheric-scatter links. This functions on the base-band combination principle. The combiner used is of the common-cathode type and the way in which the control voltages are derived from the noise levels in the two channels is described in detail. The frequency bands of the channel noise filters are located above the highest frequency of the multiplex signal. The filtering of the control voltages results from a compromise between the level of noise acceptable on these voltages and the rapidity of response desired for the system. Use of the base-band combination principle necessitates the use in each receiver channel of a continuity pilot unit in order to eliminate the possibility of a receiver failing to deliver either signal or noise. In the output from the combiner, the s./n. ratio differs < 0.5 dB from the optimum s./n. ratio. The system functions correctly for noise levels ranging from + 25 dB to − 40 dB with reference to the threshold noise level. The response time of the system is < 5 msec. A.Wilkinson

AERIALS

621.396.67

4447 GENERAL LAWS OF LINKAGE BETWEEN WAVE RADIATORS. APPLICATION TO SURFACE WAVES AND PROPAGATION. II. J.Robieux.

Ann. Radioelect,, Vol. 15, 28-77 (Jan., 1960). In French.

The theorems demonstrated in Pt I (Abstr. 7569 of 1959) of this

study are applied here to the study of surface waves. Surface waves are guided by a layer of small thickness compared to the wavelength. The wave energy is contained almost entirely outside the layer and the dimension of the wave in the direction perpendicular to the surface may be very large. By setting up discontinuities in the structure which guides the wave it is possible to obtain energy which is radiated in a highly directional manner, so that high-gain aerials can be made by applying a thin structure to a surface which may be metallic. The attendant properties are of considerable technical importance. They make it possible to design aerodynamic aerials set up on aircraft, or large aerials for metric waves, erected on the ground. The analysis of the radiating properties of the various kinds of discontinuities has been made both for the case of waves guided by a line and for those guided by a surface. The transmission coefficient and the radiation diagram of such discontinuities have been determined. On this rigorous basis the properties of aerials in which these principles are applied have been synthesized. Experiments have been worked out in detail in order to verify the theoretical predictions. Aerials have been built on the principles derived from this theory. They make it possible to solve some important technical problems.

621.396.67

4448 ELECTROMAGNETIC FIELDS WITH AXIAL SYMMETRY, BOUNDED BY CONE AND SPHERE. H.Buchholz.
Arch. Elektrotech. (Berlin), Vol. 45, No. 1, 27–48 (1960). In German.

Continuing his previous work, Ann. Phys. (Leipzig), Folge 2, Vol. 6, 185–210 (1948), the author obtains formulae for the field due to a hypothetical magnetic current ring, with various boundary conditions, to assist in calculating the radiation field from certain types of aerial. P.M.Davidson

621.396.67

4449 COMMON AERIALS. K.E.Müller and G.Martin.
Nachrichtentechnik, Vol. 10, No. 1, 14–21 (Jan., 1960). In German.

A continuation of previous work (see Abstr. 4878 of 1959) which supplements the fundamental considerations on which calculations are based and also presents experimental results which afford an explanation of the utility of the approximation relations developed. A short description is given of the experimental arrangements used in measurements of the reflection factors and voltages on the cables of a distribution network, which are also discussed theoretically. A.Wilkinson

621.396.67

4450 ON THE PAPER OF A.V.GAPONOV AND M.A.MILLER "THE INTEGRAL EQUATION FOR THE CURRENTS IN THE THEORY OF METALLIC ANTENNAS". B.V.Braude.
Zh. tekh. Fiz., Vol. 29, No. 10, 1289–90 (Oct., 1959). In Russian.
English translation in: Soviet Physics—Technical Physics (New York), Vol. 4, No. 10, 1183–4 (April, 1960).

A previous paper by Gaponov and Miller (Abstr. 4764 of 1957) criticized the method used by the author [Zh. tekh. Fiz., Vol. 25, No. 10, 1819 (1955)] for the treatment of aerial problems, in which the current causing an external e.m.f. (which in turn caused currents to flow in the aerial) was replaced by distribution of magnetic currents in the aerial. The present note is a rebuttal of the criticisms made. G.D.Sims

621.396.67

4451 ANSWER TO THE LETTER OF B.V.BRAUDE. A.V.Gaponov and M.A.Miller.
Zh. tekh. Fiz., Vol. 29, No. 10, 1291 (Oct., 1959). In Russian.
English translation in: Soviet Physics—Technical Physics (New York), Vol. 4, No. 10, 1184–5 (April, 1960).

See preceding abstract. The authors do not entirely accept B.V.Braude's rebuttal of their previous criticisms. G.D.Sims

621.396.67.095.112

4452 DESIGN AND PERFORMANCE MEASUREMENTS ON A NEW ANTI-FADE ANTENNA FOR RADIO STATION WOAI. C.L.Jeffers and S.W.Kershner.
I.R.E. Trans Broadcasting, Vol. BC-6, No. 1, 34–43 (March, 1960).

A new anti-fade type radiator is described. Vertical radiation patterns are presented on the basis of computations from predicted current distributions. Measurements on a model generally confirm the performance predicted by the computations. Skywave measurements using pulse techniques were made on the full-scale aerial to determine the optimum tuning and the suppression of skywave signals. These measurements show skywave signals transmitted by both the E and F layers of the ionosphere. Final performance data are presented, including current-distribution measurements, vertical radiation pattern and groundwave field-intensity measurements.

621.396.674

4453 METHODS FOR OPTIMUM BROADBAND OMNI-DIRECTIONAL RADIATOR. W.Stöhr and O.Zinke.
Frequenz, Vol. 14, No. 1, 26–35 (Jan., 1960). In German.

Each type of aerial of comparable form has an optimum ratio of length to diameter D for the lowest reflection factor. For conical aerials ($\approx 80^\circ$) $L/D = 0.6$ and for cylindrical aerials L/D lies between 0.9 and 1.5. Performance and engineering considerations point to the superiority of cylindrical over conical aerials. An ellipsoidal aerial for values $L/D \leq 3$ was examined; the optimum properties are within $L/D = 0.9$ to 1.5. Of the aerials considered, the semi-spherical form with a cylindrical top for $L/D = 0.94$ fed by a flared-out section has best matching properties. Although no clear results exist an amount of valuable experimental data is given for the matching of the transition between the feeder and the radiating part of the aerial. Z.F.Zoyner

621.396.677

4454 HIGH-DIELECTRIC ROD ANTENNA ARRAYS FOR U.H.F. C.W.Morrow and J.L.Moore.
Electronics, Vol. 33, No. 6, 60–2 (Feb. 5, 1960).

Sets of curves give data for dielectric-rod aerials using materials of high dielectric constant such as aluminium oxide ($k = 8.25$) or a calcium titanate ceramic ($k = 165$). By using such materials the size and weight of the rod can be kept low. The loss in the rod is not high, and consequently the power handling capacity is good. Because of their small size these rods form convenient array elements with low mutual coupling. The measured radiation patterns and side-lobe levels of typical aerials are plotted. W.T.Blackband

621.396.677 : 621.372.825

4455 THE RESONANCE EXCITATION OF A CORRUGATED-CYLINDER ANTENNA. J.R.Wait and A.M.Conda.
Proc. Instn Elect. Engrs, Monogr. 386 E, publ. June, 1960, 5 pp.
To be republished in Part C.

Radiation from an axial magnetic line or slot source on the surface of a corrugated cylinder is considered. It is indicated that the power radiated in a given mode for the structure depends critically on the surface reactance and the circumference of the cylinder. In fact, for certain value of these parameters, particular modes are strongly excited and contain most of the radiated power. Numerical results are presented for several interesting cases. The analysis is extended to an ellyptic cylinder whose surface also possesses an inductive reactance. In order to facilitate the solution it is necessary to assume a special azimuthal variation of the surface reactance. For the model as chosen, strong resonance characteristics are again obtained. This model may be adapted to study the problem of a corrugated panel on a flat metallic ground plane which is excited by a parallel slot source.

621.396.677

4456 SCANNING ANTENNA ARRAYS OF DISCRETE ELEMENTS. E.A.Blasi and R.S.Elliott.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 435–6 (Oct., 1959).

The input impedance of dipole elements which form part of a large plane array is shown to change greatly during the phase sweep of the scanning operation, and also to be extremely frequency-sensitive. The driving-point impedance tends towards a negative resistance value as a low-frequency cut is approached. It is suggested that the advantages that discrete-element arrays have through the ease of control of signal amplitude across the aperture are outweighed by the effects on the aerial gain of the impedance variations during scanning. W.T.Blackband

621.396.677

4457 ON THE USE OF UNIFORM CIRCULAR ARRAYS TO OBTAIN OMNIDIVECTIONAL PATTERNS. Ta-Shing Chu.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 436–8 (Oct., 1959).

An expression is derived for the radiation pattern of a ring array in which the radiation pattern of each element is symmetrical about the radius of the circle. If the elements are all fed in phase with equal amplitudes, then an omniazimuthal pattern will be obtained. In the plane of the ring, the pattern will have a ripple corresponding to

S, the number of elements. This ripple is shown plotted for various values of S considering the cases of elements with directional and omniazimuthal individual patterns. It is shown that the very marked ripple for omniazimuthal elements can be reduced by introducing directivity into the individual patterns. However the advantage of odd values of S may not persist when directional elements are used.
W.T.Blackband

621.396.677

4458 INVESTIGATION OF TECHNICAL APPLICATION OF CYLINDRICAL SURFACE WAVE AERIALS AS RADAR AERIALS. R.Jühn.
Nachrichtentechnik, Vol. 9, No. 9, 418-26 (Sept., 1959). In German.

Metal cylinders with circular slots are analysed as radiating aerials when they are excited by a horn feeding various modes of electromagnetic waves. Radiation characteristics are worked out and it is shown that well defined beams can be produced. A combination of radiators can produce a scanning beam with purely electronic control by rotating the polarization of the electromagnetic waves.
A.Woroncow

621.396.677

4459 EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON PLANE SURFACE AERIALS. S.Blume.
Z. angew. Phys., Vol. 12, No. 2, 72-87 (Feb., 1960). In German.

The radiation field of a sectorial aerial is represented further (see Abstr. 2507 of 1960) by spherical waves of the electric type. Good agreement exists between the theory and the experimental results for a sectorial aerial with an aperture angle of 90°; moreover, 90°- aperture aerials possess optimum broadband characteristics. The broadband considerations suggest the use of lemniscate-shaped plane-surface aerials. The calculated distribution of the current density on a sectorial aerial yields the results expected: maximum density at the edges of the sector, minimum density in the middle of the sector.
Z.F.Voyner

621.396.677.41

4460 A SINGLE-WIRE TRAVELLING-WAVE AERIAL FOR MEDIUM-WAVE RECEPTION.
S.P.Belousov and V.G.Yampol'skii.
Radiotekhnika, Vol. 15, No. 1, 16-25 (Jan., 1960). In Russian.

Examines the design criteria of a single-wire travelling wave aerial (Beverage aerial) and of several of its variants. The maximum gain is dependent on the optimum length of the aerial which varies with the nature of the soil and with the probable angle of tilt of the incoming wave. An approximate expression is obtained for the optimum length of the aerial for arbitrary values of the attenuation coefficient.
Z.F.Voyner

621.396.677.5

4461 EXTENSION OF THE VALIDITY RANGE OF CALIBRATION EQUIPMENT FOR LOOP AERIALS. E.Zühlke.
Nachrichtentechnik, Vol. 10, No. 1, 21-3 (Jan., 1960). In German.

The calibration method of Swinyard (Abstr. 1801 of 1941) is extended so as to be applicable to arbitrary values of l/λ, l being the distance between the transmitting and receiving aerials. The effect of ground characteristics, however, remains unconsidered.
A.Wilkinson

621.396.677.6

4462 THE THEORY OF THE GENERAL ADCOCK DIRECTION-FINDER. K.Baur.
Arch. elekt. Übertragung, Vol. 14, No. 1, 1-14 (Jan.); No. 2, 57-69 (Feb., 1960). In German.

The theory of the stationary Adcock direction-finder is presented in a manner sufficiently general to cover all cases likely to be encountered in practice. This generalization is made possible by taking account of the mutual coupling inside the system and by the arbitrariness of the radiation properties of the individual aerial elements. The limiting condition is imposed by the orientation of the elements in space and thier uniformity making the system geometrically and electrically periodic over 360° in azimuth. The calculations presuppose the knowledge of the gain function for the existing polarization characteristics and the corresponding phase centre.
Z.F.Voyner

621.396.677.81

4463 AIRBORNE DUAL ANTENNA SYSTEM FOR AERIAL NAVIGATION. W.Spanos and J.M.Ashbrook.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 4, 211-18 (Dec., 1959).

Describes a 1 Gc/s dual aerial system which uses parallel-driven sector aerials. Methods for determining the performance in pattern interference regions are given together with applications to D.M.E. Radar Safety Beacon and Tacan navigation systems. A flyable-model dual aerial system for Constellation and DC-6 type aircraft is described. Provision of an r.f. hybrid permits the simultaneous operation of two navigation equipments, such as D.M.E. and Radar Safety Beacon, from the same aerial. A prototype of this system on a DC-3 has provided improved performance for the Tacan navigation system. Flight tests with an experimental dual aerial system have shown improved performance for D.M.E. and Radar Safety Beacon systems. The results of flight tests show agreement with theoretically determined values of performance.

621.396.679.4

4464 50-kW ANTENNA SWITCHING SYSTEM. J.W.Smith.
I.R.E. Trans Commun Syst., Vol. CS-7, No. 4, 295-301 (Dec., 1959).

Describes several components and techniques that solve the transmitter–aerial selection problem up to a 50-kW power level. The influence of switching techniques on r.f. transmission, impedance conversion and aerials is also discussed.

621.396.679.4

4465 EARTHED-BASE MEDIUM-WAVE RADIATORS OF EXTENDED BANDWIDTH AND A SUITABLE MATCHING CIRCUIT. H.Scholz.
Rdfunktech. Mitt., Vol. 3, No. 2, 97-101 (April, 1959). In German.

Deals with the advantages of earthing aerial masts at the base, when in addition to supporting television and v.h.f. aerials they are also used for medium waves. The main disadvantage of such aerial masts is their small bandwidth: it is shown that the bandwidth may be extended by means of suitable matching circuits. Attention is paid to matching the entire frequency to the individual frequency response of the aerial input impedance.

621.396.679.4

4466 GOUBAU [SURFACE-WAVE] TRANSMISSION LINES FOR TRANSMITTERS: CHARACTERISTICS AND OPERATIONAL EXPERIENCE. F.R.Huber and H.Rudat.
Rdfunktech. Mitt., Vol. 3, No. 6, 277-83 (Dec., 1959). In German.

Describes the use of a surface-wave transmission line in a novel fashion to feed a transmitting aerial, this device having heretofore been used mainly for transmitting energy over long distances. Questions concerning damping and matching, as well as with the radiation from the line, are discussed. The transmitting properties of the aerial array are not affected by radiation at the coupling elements.

PROPAGATION . INTERFERENCE

621.391.8

4467 COMPARATIVE EVALUATION OF COMMUNICATIONS TRANSMISSION MEDIA. J.H.Vogelman.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 230-1 (Dec., 1959).

The selection of communications transmission media for any specified operation is neither a purely technical problem nor a purely economic one, but a complex combination of these two factors. To minimize work involved in evaluating all the possible choices, a first-order approximation method is provided to limit the number of specific transmission media which must be considered in any specific application. This method provides a numerical measure of the expected combination of technical and economic factors and is based on the author's empirically derived experience with communications equipments and systems.

621.391.8

4468 EFFECTS OF NONLINEARITY ON PROPAGATION IN IONIZED MEDIA. G.I.Cohn.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 942-9 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

The steady-state propagation of a plane-polarized wave is investigated for a medium which is homogeneous in the absence of a field and nonlinearly conducting, and which contains no ambient electric or magnetic field. For the single frequency excitation through quadratic terms in the electric field intensity, the principal effects

are the generation of three double-frequency waves, two in the forward direction and one propagating backward. These may give rise to an important level of interference. W.T.Blackband

621.391.812

4469 A NEW METHOD FOR STUDYING THE AURORAL IONOSPHERE USING EARTH SATELLITES.
R.Parthasarathy, R.P.Basler and R.N.DeWitt.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1660 (Sept., 1959).

The fact that sputnik III travels from due West to due East over the Geophysical Institute College, Alaska, has enabled measurements of the radio-absorbing height of the aurora to be made by observation of the sputnik's 20 Mc/s transmission. The height for the absorbing region in one instance has been observed to be 104 km. Further observations have shown that the phenomenon of scintillation arises from irregularly ionized zones occurring as high as 1000 km. G.D.Sims

621.391.812

4470 THE ELECTRON CONTENT AND DESTRUCTION IN THE IONOSPHERE. T.G.Hame and W.D.Stuart.
Proc. Inst. Radio Engrs, Vol. 48, No. 1, 364-5 (March, 1960).
From records of Fanaday fading of signals of Sputnik III on 20 and 40 Mc/s, values have been deduced for the total number of electrons between ground and satellite. The analysis used assumes that the satellite is near apogee or perigee, and neglects the effects of earth curvature. Diurnal variations in the ratio of electrons above and below the F_2 max. are reported, this ratio being about 3 : 1 at noon and 1 : 1 at midnight. W.J.Blackband

621.391.812.3 : 538.56

4471 THE LOWER FREQUENCY LIMITS FOR F-LAYER RADIO PROPAGATION.
B. Fulton, O.Sandoz and E.Warren.
J. geophys. Res., Vol. 65, No. 1, 177-83 (Jan., 1960).

The band of frequencies propagated via the ionosphere by the high-angle ray and that propagated by the low-angle ray are both limited at their low-frequency ends by reflections that occur at lower ionospheric heights. Methods are developed for the calculation of these limits.

621.391.812.6

4472 THE SYNTHESIS OF THE FORM OF ATMOSPHERICS AND THE EFFECTIVE PARAMETERS OF THE LOWER PART OF THE IONOSPHERE AT LOW FREQUENCIES.
Ya.L.Al'pert and D.S.Fligel' .
Radiotekhnika i Elektronika, Vol. 4, No. 2, 202-11 (Feb., 1959).
In Russian.

The results of theoretical calculations of the characteristics of atmospherics using a particular ionospheric model and their comparison with signals received at distances of 500-3000 km are described. The theoretical and experimental results agree in detail in up to 60% of the cases investigated, indicating the correctness of the model of the ionosphere chosen. [English summary: PB 141106 T--13 obtainable from Office of Technical Services U.S.Dept. of Commerce, Washington D.C., U.S.A.]. R.C.Glass

621.391.812.62 : 538.56

4473 AN ANALYSIS OF TIME VARIATIONS IN TROPOSPHERIC REFRACTIVE INDEX AND APPARENT RADIO PATH LENGTH. M.C.Thompson, Jr., H.B.Janes and A.W.Kirkpatrick.
J. geophys. Res., Vol. 65, No. 1, 193-201 (Jan., 1960).

The results of a series of measurements for a study of the characteristics of the turbulent lower atmosphere and its effect on the accuracy of radio direction-finding, guidance, and geodetic measurement systems are presented. One experiment consists of recordings of refractive index and apparent path length variations at 9400 Mc/s over a 15.5 mile path on Maui, Hawaii and the other two experiments consist of similar measurements made over a 9.5 mile path near Boulder, Colarado. The correlation of refractive index and apparent path length fluctuations is discussed as well as the power (variance) density spectra of both variables.

621.391.812.624

4474 THE EFFECTS OF LOW-NOISE TECHNIQUES ON TROPOSPHERIC SCATTER COMMUNICATIONS.
A.Feiner and D.Savage.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 302-6 (Dec., 1959).

Defines the expected benefits to be derived from the use of low-noise receiver techniques when applied to tropospheric scatter systems in the 1 to 2 Gc/s range. Calculations were made of the expected aerial noise temperatures for "smooth" and "rough" ground locations. These data, plus the known and anticipated performance of various low-noise techniques, permitted the calculation of increased sensitivity. The sensitivity improvement is then expressed in terms of increased range, decreased transmitter power, and decreased aerial size.

621.391.812.624

4475 THE DEPENDENCE OF COMBINER DIVERSITY GAIN ON SIGNAL LEVEL DISTRIBUTION.
B.Easter, C.H.Maddock and R.G.Medhurst.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1651-2 (Sept., 1959).

For the case of a signal with a fading law of the form $P \propto V^k$ where P is the probability that the received voltage will not exceed a level V in one path, a graph of combiner diversity gain is plotted as a function of k. The results are shown to be in agreement with those of Altman and Sichak, (Abstr. 4749 of 1957) and Staras (Abstr. 2379 of 1957), calculated for the particular case of Rayleigh fading. G.D.Sims

621.391.812.63 : 538.56

4476 SOME OBSERVATIONS OF IONOSPHERIC FARADAY ROTATION ON 106.1 Mc/s. R.A.Hill and R.B.Dyce.
J. geophys. Res., Vol. 65, No. 1, 173-6 (Jan., 1960).

The polarization twist imposed on 106.1 Mc/s radio waves by the ionosphere was investigated by using the moon as a passive reflector, the purpose being to determine the total electron column density even at altitudes above the known ionosphere. Because the aerial was capable of being continuously directed at the moon for 12 consecutive hours, observations were possible from the pre-dawn ionization minimum to the noon-time maximum. A true-height profile computed from vertical-incidence ionosonde data of September 16, 1957, suggests that the total electron content throughout the entire ionosphere is not a constant factor of the integrated electron content computed up to the level of maximum ionization density.

621.391.812.63

4477 LONG-DISTANCE TRANSMISSION VIA THE F2 LAYER IN THE WAVEBAND 40-52 Mc/s. H.Wisbar.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 11, 547-53 (Nov., 1959).
In German.

A detailed account of the reception in Germany of transmissions from the U.S.A. on frequencies of 43.6 and 50-52 Mc/s, with discussion of the effects of sporadic E layers, aurorae, scattering and interference. See also Abstr. 1796 of 1959. A.Wilkinson

621.391.822

4478 FUNDAMENTAL LIMITATIONS OF EXTERNAL NOISE. H.H.Grimm.
I.R.E. Trans Instrumentation, Vol. I-8, No. 3, 97-103 (Dec., 1959).

Presents design relations, or analytical methods, which permit approximate evaluation of most noises encountered. Noise sources discussed are those due to the aerial and transmission-line components, the atmosphere, the warm earth, and space beyond the ionosphere. The discussion utilizes the concept of excess noise temperature currently popular in the low-noise receiver art. The conclusions reached are that: (1) excess noise due to absorbing media at uniform temperatures is easily evaluated using present information; (2) noise due to the non-homogeneous atmosphere is beginning to get some attention and the need for more intensive work is indicated; (3) aerials noise leakage data are inadequate at present, but suitable measurements and computations will clearly be required in the near future; and (4) radio sky background temperatures are in the least satisfactory stage of all the pertinent factors at present, and absolute background measurements cannot be made before aerial sidelobe leakage is more carefully evaluated.

621.391.812.63

4479 THE N.B.S. METEOR BURST COMMUNICATION SYSTEM. R.J.Carpenter and G.R.Ochs.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 263-71 (Dec., 1959).

This project was undertaken in 1955 to investigate the properties of the intermittent reception of v.h.f. signals over long distances by meteoric propagation and their communication usefulness. To accomplish this, a complete duplex teletype system operating at about 50 Mc/s was constructed, and results are reported from tests made over a 1277 km east–west path. Comparisons are made of burst transmissions of 10, 20, 40, and 80 times normal teletype speed and of variations in a number of control system parameters.

For the system under test, the optimum speedup was 40X, which produced a daily average channel capacity of about 40 words/min with a character error rate of about 0.0035 (with the best control system settings). Higher speedup ratios are advocated for future systems. The most serious causes of outages in this type of system are atmospheric noise and sustained multipath distortion from competing modes such as E_s and auroral propagation.

621.391.821

4480 A STUDY OF ATMOSPHERIC RADIO NOISE RECEIVED IN A NARROW BANDWIDTH AT 11 Mc/s. C.Clarke.
Proc. Instn Elect. Engrs, Paper 3158 E, publ. May, 1960 (Vol. 107B, 311-19).

Equipment is described for studying atmospheric radio noise by means of continuous-film photography and by measuring the amplitude probability distributions by a pulse-counting technique. Results are given for observations in England during the summer and autumn of 1956. The observations were made in a bandwidth of 400 c/s. No simple mathematical representation of the amplitude probability distribution has been found which will fit all conditions, and a graphical presentation is suggested as a means of providing communication engineers with the required data. The high-frequency radiation consists of a burst of quasi-continuous noise throughout the duration of the flash. This suggests that a burst-duration distribution may be a useful additional measurement in defining the interference effect of the noise.

621.391.823

4481 STATISTICAL ASSESSMENT OF FREQUENCY AND MAGNITUDE OF INDUCTIVE INTERFERENCE OF TELECOMMUNICATION LINES BY HIGH VOLTAGE LINES.
W.Erbacher.
Österr. Z. ElektWirtsch. (Ö.Z.E.), Vol. 13, No. 1, 1-9 (Jan., 1960). In German.

Calculations of inductive interference are based generally on the assumpton that all parameters have most unfavourable values. This coincidence is unlikely, and an attempt is made, for a particular network, to calculate the probability that the highest value is obtained. Taking into account length and position of the exposure, locality of the earth fault, actual short-circuit power of the network when the fault occurs, and actual load, it is found that for 90% of all faults the induced voltage is less than 0.6 of the highest value. H.R.J.Klewe

RADIO APPLICATIONS . RADAR

621.396.931

4482 THE CHALLENGE OF UNIVERSAL MOBILE COMMUNICATIONS. A.F.Culbertson.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 973-9 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

A report is made on the problem of universal mobile communications in the U.S A. System performance and design objectives are considered and some suggestions are made regarding the solution of some of the difficulties encountered. In particular such aspects as spectrum stretching, mobile switching arrangements, automatic location of mobile subscribers and the maintenance of continuity of service when passing through region boundaries are discussed.
H.L Nattrass

621.396.933.2 : 621.396.969.11

4483 POSITION ESTIMATION USING ONLY MULTIPLE SIMULTANEOUS RANGE MEASUREMENTS.
H.L.Groginsky.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 3, 178-87 (Sept., 1959).

Three-dimensional generalized position-measurement systems are analysed. In these systems, target position is obtained by trilateration using only range data collected by a group of ν stations located in an arbitrary geometry. The method of maximum likelihood is used to obtain a joint estimator for the target coordinates which makes optimal use of the redundant data when the noise is Gaussian. A simple recursion formula for the estimator is obtained for this purpose and is shown to be convergent. This formula makes it possible to add data from a redundant number of stations at will and in proportion to their relative reliability. Further, it is shown that the recursion formula can be written entirely in terms of the changes in the successive iterative target position estimates. This technique offers a new means of obtaining tracking data on a moving target since it permits changes in target position to be computed directly as new data are obtained. The covariance matrix of the joint three-dimensional estimator is obtained in the case in which the measurement noise is small compared to the distances measured. The mean-square position error, namely, the trace of the covariance matrix, is shown to have a simple form for the general two-dimensional system in which the target and stations are coplanar. The geometry enters the variance expression only through the angles of cut θ_{ij}, which are the angles between the lines joining the target and the stations. The surveillance regions of various redundant two-dimensional systems obtained by using the joint estimator are compared to that obtained by using only pairwise estimation. It is found that little improvement is made when the distance of the target to all the stations is much greater than the distance between stations.

621.396.944

4484 AN UNDERWATER COMMUNICATION SYSTEM.
N.D.Miller.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 249-51 (Dec., 1959).

Communications between submerged submarines and surface craft require energy to be propagated through sea water. The only practical method for transmitting this energy is by acoustic means. Both f.m. and a.m. transmission systems have been used, but for long-range communication, a single-sideband suppressed-carrier transmission system is the only effective way of propagating sound energy. The requirements for the transmission system and diagrams of the circuitry are given.

621.396.946

4485 DESIGN CONSIDERATIONS FOR SPACE COMMUNICATION. J.E.Bartow, G.N.Krassner and R.C.Riehs.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 232-40 (Dec., 1959).

The use of earth satellites for communication purposes has been the subject of considerable study both by military and commercial organizations in the communications field. The problems involved in space communication are delineated, and the assumptions that must be made and the technical limitations which determine the communication system that should be used for a particular time frame are considered. Some characteristics for an optimum system are stated. Some technical characteristics of the first successful satellite communication system are given.

621.396.946

4486 COMMUNICATION USING EARTH SATELLITES.
J.B.Wiesner.
I.R E. Trans Military Electronics, Vol. MIL-4, No. 1, 51-8 (Jan., 1960).

A review of the use of earth satellites for reliable, ionospheric-independent communication circuits includes considerations of losses in the propagating path, directivity features, and influences such as Doppler shift. The effects of such influences on bandwidth and range are illuminated.

621.396.946

4487 MEASUREMENTS ON THE DOPPLER–FIZEAU EFFECT FOR ARTIFICIAL SATELLITES.
G.Boudouris, J.Bournazel and E.Vassy.
Onde elect., Vol. 39, 934-8 (Dec., 1959). In French.

An outline is given of the Doppler effect observed with artificial satellites. A simple installation is described which has been used for the recording of satellite signals. The Doppler shift is recorded on a magnetic tape, and also by the timed photography of Lissajous figures on a c.r.o. Examples are given of measured Doppler curves. One of these shows marked discontinuities due to ionospheric irregularities. The orbit parameters are deduced by fitting a cubic curve to the observed data. Bibliography of 37 refs.
W.T.Blackband

621.396.946

4488 DETERMINATION OF THE ORBIT OF AN ARTIFICIAL SATELLITE. J.T.Anderson.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1658-9 (Sept., 1959).

The 4-section Doppler system proposed by Carrara, Checcacci and Ronchi (Abstr. 3193 of 1959) is discussed. Theoretically such a system could lead to a complete solution of the orbit. However in the case where neither the transmitting frequency nor the range at some part of the orbit are known, the solution relies upon second-order differences between the data which, at the frequencies usually

employed, are of the order of magnitude of the errors in the system. Iterative methods can be used, and the choice is often between the installation of a computer or a radar. An outline is given of several multi-station Doppler tracking systems. W.T.Blackband

621.396.96

4489 THE APPLICATION OF RADIO INTERFEROMETRY TO EXTRATERRESTRIAL METROLOGY. M.J.E.Golay.

I.R.E. Trans Space Electronics and Telemetry, Vol. SET-5, No. 4, 186-93 (Dec., 1959).

Following an introductory discussion of the interferometric method, the essential building block of an interferometric system, the interferometric link, is discussed, especially with reference to the transmit–receive problem and to the noise problem in a frequency tracking circuit. One form of phase-locked loop is discussed in connection with the latter. Several possible interferometric applications are listed and a table is presented in which an attempt has been made at estimating the essential parameters of each system.

621.396.96 : 551.5

4490 CORRELATION STUDIES OF RADIO-AURORA, MAGNETIC, AND EARTH-CURRENT DISTURBANCES.

B.K.Bhattacharyya.

Canad. J. Phys., Vol. 38, No. 5, 624-37 (May, 1960).

Correlation studies of the radar echo occurrence rate from aurora in half-hourly intervals at Ottawa, S and S_d components of the horizontal magnetic field H at Agincourt, and the disturbance diurnal variation of earth current at Crow River have been carried out. Short-time variations in auroral echo strength and moderate perturbations in H have also been correlated. The auroral echo occurrence rate seems to have a diurnal variation characteristic similar to that of H. It is found that auroral activity always precedes magnetic activity. The variation of the delay time between the two phenomena shows a local time-dependence, being practically constant and quite small (0-15 minutes) before local midnight and increasing afterwards. This variation of the delay time appears to have a connection with reports of others regarding reversal of the direction of auroral ionization drift from west to east somewhere around midnight with subsequent magnetic perturbations which change from positive to negative. No definite conclusion could be reached regarding the relationship of earth current to other factors because of a practically random variation of cross-correlation coefficients from month to month.

621.396.96

4491 GEOMETRICAL OPTICS APPROXIMATION OF NEAR-FIELD BACK SCATTERING. F.S.Holt.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 4, 434-5 (Oct., 1959).

An expression is derived for the effective radar back-scattering cross-section of a convex doubly-curved perfectly conducting surface in the far field of a radar, for the cases when the radar is close enough to be in the near field of the reflected signal. For lunar radar reflections the earth is in the near field, but it is shown that in this case the near-field back-scattering cross-section differs by $< 1\%$ from that calculated on the basis of far field. W.T.Blackband

621.396.96

4492 THE INDETERMINACY OF MEASUREMENTS PERFORMED BY RADAR EQUIPMENT. R.Madden.

I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 4, 219-20 (Dec., 1959).

A theoretical deviation of the indeterminacies of simultaneous position and velocity measurements of a reflector when using reflected electromagnetic waves is given. It is shown that the product of the indeterminacies is given by $(1/8\pi)/\lambda_s c$ where λ_s is the illuminating wavelength and c the speed of light. It is shown that the necessary consequence of nonsimultaneous measurements is an uncertainty as to whether the measurements are common to the same reflector. If this uncertainty is to be overcome, the reflectors must be spaced at a distance $\frac{1}{2}c\Delta T$ where ΔT is the time separation of the position and velocity measurement.

621.396.96

4493 PRINCIPLES OF ELECTRONIC NAVIGATION SYSTEMS. P.C.Sandretto.

I.R.E. Trans. Aeronaut. Navig. Electronics, Vol. ANE-6, No. 4, 221-8 (Dec., 1959).

Electronic navigation systems of all types are discussed, and classified as classical or self-contained. The error rates and accuracies of the various systems are discussed.

621.396.96

4494 THE USE OF QUICKENING IN ONE COORDINATE OF A TWO-DIMENSIONAL TRACKING SYSTEM.

J.W.Duey and R.Chernikoff.

I.R.E. Trans Human Factors Electronics, Vol. H.F.E.-1, No. 1, 21-4 (March, 1960).

In a previous study [Naval Research Laboratory, Washington, D.C., Report 5425; Nov., 1959] it was found that tracking error in one coordinate of a two-dimensional tracking system was affected by the dynamics used in the other coordinate. In particular, tracking performance progressively deteriorated as the dynamics in the two coordinates became more dissimilar. An attempt is made to extend these findings by determining how the introduction of quickening into one coordinate of a second-order, two-coordinate tracking system system would affect the performance in the unquickened coordinate. In the light of the previous study, it might be expected that quickening one coordinate would degrade the performance of the other. On the other hand, the simplification of the tracker's task induced by quickening might effect an improvement in performance. The findings suggest that a counterbalance of the above factors was achieved, since quickening one coordinate had no affect on performance in the other.

621.396.96 : 621-52

4495 THE RELATION OF ELECTRONIC AND OPTICAL DISPLAY GAIN TO SYSTEM PERFORMANCE.

S.Seidenstein and H.P.Birmingham.

I.R.E. Trans Human Factors Electronics, Vol. HFE-1, No. 1, 30-2 (March, 1960).

An experiment was conducted to investigate the effect of adjusting display gain upon man–machine system performance in a simple aided tracking system. Gain was varied in two ways: electrically by changing amplification, and optically by changing the distance from the scope to the eye. Manipulation of gain by each method produced similar changes in system performance. Over the ranges studied, system error decreased as display gain was increased. This result agrees with predictions based upon closed-loop control system theory and suggests the feasibility of including additional experimental variables within the theory.

621.396.96

4496 SUB-HORIZON RADAR ECHOES BY SCATTER PROPAGATION. D.Atlas.

J. geophys. Res., Vol. 64, No. 9, 1205-18 (Sept., 1959).

Deals with a unique 3-cm radar observation in which echoes arranged in cellular and striated patterns were detected out to a maximum range of ninety miles. The cellular structure closely resembles a Benard convection pattern and the cell scale is consistent with that to be expected when convection is restricted to a layer of the observed depth. The echoes cannot be attributed to clouds or precipitation, which were absent. Birds, insects, or other particulate matter are also illogical targets. Direct back-scatter or angel echoes from atmospheric inhomogeneities are also precluded except at very short ranges because of the restricted echo heights and great ranges. The echoes can only be attributed to a mechanism of forward scatter by atmospheric eddies to ground targets and back via the same path. The resulting echo structure is then that of the convectively patterned atmospheric "mirror" upon which are superimposed the more prominent features of the topography. Theoretical analysis indicates that the magnitude of the forward-scatter intensity function must be extremely high. However, extrapolation of the frequencies with which smaller scatter intensities have been observed indicates that the required magnitude might be expected to occur with a frequency which is in general accord with the rarity of the present phenomenon. Although the required index irregularities are extremely sharp, they are physically conceivable.

621.396.96

4497 RADAR "RING ANGELS" AND THE ROOSTING MOVEMENTS OF STARLINGS.

E.Eastwood, G.A.Isted and G.C.Rider.

Nature (London), Vol. 186, 112-14 (April 9, 1960).

Reports and discusses further the information to be obtained from studies of the "ring angels" reported by Eastwood, Bell, and Phelp (Abstr. 6788 of 1959). New information on the migrating and roosting habits of starlings within a radius of 40 miles of Chelmsford is obtained. This information would not have been forthcoming from normal visual ornithological studies. C.A.Hogarth

621.396.96 : 612.843.6 : 621.389

ON THE FACTORS WHICH AFFECT THE PERFORMANCE OF A RADAR OPERATOR. See Abstr. 4386

621.396.96 : 621.374.33

TIME GATE FOR ECHO-MEASURING RADAR INSTALLATIONS. See Abstr. 4216

621.396.967

4498 RADAR BEACONS FOR I.R.B.M./I.C.B.M. F.J.Clark.

I.R.E. Trans Military Electronics, Vol. MIL-3, No. 4, 175-7 (Oct., 1959).

Summarizes problems in the design of radar beacons and beacon aerials used in i.r.b.m. and i.c.b.m. test vehicles. The most important factors which affect compatibility between the beacon and tracking radars at the test range are enumerated. Design areas which should be correlated with the test range prior to finalization of beacon criteria are also given.

621.396.969

4499 TRACKING RADAR FOR TIROS WEATHER SATELLITE. H.E.O'Kelley.

Electronics, Vol. 33, No. 16, 57-60 (April 15, 1960).

Describes an aerial system for tracking meteorological satellites. The primary function of the aerial is to provide data on the 216-260 Mc/s telemetry band and monitoring at 108 Mc/s. Polarization diversity requires linear, right- and left-hand circular polarizations. This is achieved in the primary feed by suitably spacing two orthogonal probes in the circular waveguide cavity propagating in the H_{11}-mode. Conical scanning is obtained by electrically offsetting the beam by means of a hemispherical dielectric lens spinning at 600 rev/min and mounted in the feed assembly. The cross-over point is at −1 dB and the construction of the prism is given in some detail. Automatic tracking information is obtained through position-amplitude modulation of the satellite's carrier signal. The aerial will accelerate at 4 degrees/sec^2 up to a maximum velocity of 8 degrees/sec; the tracking error is not less than 0.03 degrees for a satellite subtending an arc of 1 deg/sec.

Z.F.Voyner

621.396.969.35

4500 HIGH-ACCURACY ELECTRONIC TRACKING OF SPACE VEHICLES. P.F.von Handel and F.Hoehndorf.

I.R.E. Trans Military Electronics, Vol. MIL-3, No. 4, 162-72 (Oct., 1959).

It is shown that optical accuracies can be reached with electronic tracking if the refractive index is known at the site of the radar, as well as at the site of the target. This is the case in tracking space vehicles with microwaves. The index can be measured at the tracking site and it is unity beyond the denser atmosphere. Ionospheric influences can be neglected in the higher kilomegacycle range. It is also shown that the uncertainty of the course of any particular profile between the surface of the earth and the target has only minute effects on range and angular errors. Accuracy limits are determined and presented numerically. The inherent high precision of modern electronic tracking systems can be fully utilized under these conditions; this is not the case in tracking vehicles flying in the atmosphere.

621.396.969.35 : 525

4501 AMATEUR RADIO MEASUREMENT OF SOVIET SATELLITES I AND II. J.Heywood.

J. Brit. Astron. Assoc., Vol. 70, No. 2, 79-89 (Feb., 1960).

An account of field-strength and Doppler-shift measurements made by a number of amateur groups in Great Britain. A detailed account is given of the method used to measure Doppler shifts and of the method of reduction of the results. C.Hazard

621.396.97

4502 THE TECHNICAL PROBLEMS OF BROADCASTING. II. MANAGING THE LOW FREQUENCIES. D.E.L.Shorter.

Engineering, Vol. 189, 100-1 (Jan. 15, 1960).

For part I, see Abstr. 1884 of 1960. In broadcasting, audio-frequency engineering developments centre on microphones, loudspeakers, monitoring equipment and the problem of conveying signals from studio to transmitter. A short account is given of work carried out by the B.B.C. in these fields, with references to detailed descriptions published in recent years. Among the developments mentioned may be noted the pressure-gradient microphone for discrimination against extraneous noise, high-quality monitoring loudspeakers and methods for testing them, measurement of the nonlinear distortion in a transmission chain, and a new method of assessing the results of a harmonic-distortion test. A.Wilkinson

621.396.97 : 621.397.6

4503 THE TECHNICAL PROBLEMS OF BROADCASTING. III. LINKING THE TELEVISION NETWORK. J.C.Gallagher; IV. FEEDING THE TRANSMITTING AERIAL. F.D.Bolt. Engineering (London), Vol. 189, 168-9 (Jan. 29); 241-2 (Feb. 12, 1960).

For Pt II, see preceding abstract. An account is given of the permanent network linking the B.B.C.'s studio centres with the transmitting stations in various parts of the country, also of the special equipment and frequencies used for connection between outside sound or television broadcasting points with the permanent network. Various difficulties encountered in such work are discussed and the means adopted to overcome them described. Photographs of some of the latest types of transportable equipment are shown. Pt IV describes the means adopted to reduce losses in feeders connecting transmitters to aerials. The loss due to conductor resistance is the major cause of inefficiency, and the resultant heating limits the maximum power that can be conveyed at the very high frequencies used for television and sound broadcasting to a small fraction of the power that can be transmitted at 50 c/s over conductors of comparable size. Two main types of coaxial transmission line having characteristic impedances of either 70 or 50 ohms are in use by the B.B.C: (a) rigid lines built up from 12ft lengths of copper tube; (b) semiflexible cables in continuous lengths up to 600ft. An intermediate type with a built-up rigid outer conductor and a continous semiflexible inner conductor has been in use for a number of years. Both rigid and semiflexible lines are kept dry and clean by means of filtered and dehydrated air at a pressure of some 12in. water gauge. The effects of reflections at the ends of aerial feeders, which might produce distortion, are minimized by the insertion of accurately adjusted transforming and phase-correcting networks between the end of the feeder and the aerial. A.Wilkinson

TELEVISION

621.397.12 : 621.391.8

4504 WIDE-BAND FACSIMILE TRANSMISSION OVER A 900 MILE PATH UTILIZING METEOR IONIZATION. W.H.Bliss, R.J.Wagner, Jr and G.S.Wickizer.

I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 252-6 (Dec., 1959).

Preliminary tests of facsimile transmission over a 910 mile path were made at 40 Mc/s by means of intermittent meteor ionization. Printed matter was scanned at a rate of 2 frames/sec with a resolution of 67 elements/in. An all-electronic facsimile system recorded a picture when the received signal rose above a preset threshold. Tests were conducted employing bandwidths up to 110 kc/s with keying frequencies up to 73 kc/s still maintaining the same optical resolution in the facsimile material. With the equipment used in the tests, it appeared that the maximum bit rate for acceptable facsimile was about 48 000 bits/sec at 2% duty cycle and about 86 000 bits/sec at 1% duty cycle. Examples of signal recordings with received facsimile are shown. Preparations are being made to conduct similar tests, employing a higher information rate and wider bandwidth, on a frequency near 50 Mc/s.

621.397.12

4505 A VERY HIGH-SPEED FACSIMILE RECORDER. G.M.Stamps and H.C.Ressler.

I.R.E. Trans Commun. Syst., Vol. CS-7, No. 4, 257-63 (Dec., 1959).

An operating facsimile system is described which is capable of transmitting black and white graphic information at the rate of 24 in. of copy feed per second. The system uses conventional line-by-line sequential scanning at the transmitter and a multistylus recorder with 100 lines per inch resolution at the receiver. The electrolytic recording medium employed is characterised by a relatively low internal impedance, which permits close spacing of the stylus electrodes and the use of direct-coupled transistors for the individual marking amplifiers. The high transmission speed results from the use of individual stylus electrodes for each elemental area along the scanning line and the holding of the video marking signal at each stylus for time intervals approximating the

duration of a complete scanning line. The system described uses a 100 stylus block assembly, restricting the length of the scanning line to one inch. Block assemblies with 10^3 styli have been made and these will permit reproduction of copy 10 in. wide.

621.397.2

4506 THE TECHNICAL CONSIDERATION OF TELEVISION IN THE INTERNATIONAL FIELD. T.Kilvington.

J. Brit. Instn Radio Engrs, Vol. 20, No. 4, 293-6 (April, 1960).

Refers to the new C.C.I.R. recommendations which fall into two groups; those concerned with parameters which apply at any video point (e.g. impedance of circuit, amplitude of signal, etc.), and those concerned with the transmission system (e.g. signal/noise ratio and linearity). V.G.Welsby

621.397.23

4507 TROPOSCATTER COMMUNICATIONS FOR INTER-CONTINENTAL TV TRANSMISSION. E.Dyke.

J. Soc. Motion Picture Televis., Vol. 69, No. 2, 81-8 (Feb., 1960).

Tropospheric-scatter phenomena are described, inventions enabling a better carrier/noise ratio to be obtained are discussed and problems met with in the installation and operation of the D.E.W. link system across North Canada are described. General and technical problems of a proposed NARCOM intercontinental T V system are also considered. A.Wilkinson

621.397.3

4508 A PROBABILISTIC MODEL FOR RUN-LENGTH CODING OF PICTURES. J.Capon.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 4, 157-63 (Dec., 1959).

A first-order Markoff process representation for pictures is proposed to study the picture coding system known as run-length coding (differential-coordinate encoding). A lower bound for the saving in channel capacity is calculated on the basis of this model, and is compared with the results obtained by previous investigators. In addition, this representation is shown to yield an insight into the run-length coding system which might not otherwise be obtained. The application of this probabilistic model to an "elastic" system of run-length coding is also discussed.

621.397.331.24

4509 THE FINE-DETAIL CONTRAST OF TELEVISION PICTURE TUBES. F.Arp.

Rdfunktech. Mitt., Vol. 3, No. 3, 105-13 (June, 1959).

Reports measurements of the fine-detail contrast which were made of the luminous density of a square, produced electronically, or of a vertical strip with constant luminescence of the surrounding background. By altering the size of these test figures the change from the contrast of large surface to the naturally inferior fine-detail contrast is obtained for a constant signal level. These measurements follow a trend which may be approximated to a linear characteristic. Further observations show that the transmission characteristics of a picture tube cannot be represented fundamentally by an equivalent quadripole. The investigations were made on two 43 cm picture tubes with and without safety screens.

621.397.334

4510 FLYING-SPOT SCANNING FOR OPAQUE COLOUR PICTURES. N.Mayer.

Rdfunktech. Mitt., Vol. 3, No. 3, 123-31 (June, 1959). In German.

Flying-spot scanning offers a simple method for deriving the colour signals for red, green and blue (Vitascan) even from opaque colour pictures. The flying spot of a scanning tube is thrown on to the picture to be transmitted and, in the simplest case, the three colour signals are produced by means of three photoelectric cells. This avoids the difficulties of three-fold registration of the colour rasters, such as occur with colour television cameras with three pick-up tubes. After describing the arrangement for signal production and the calculation of the signal-to-interference ratio, some peculiarities of the method are discussed and partly demonstrated with a colour photograph of the screen, which was produced with a simple experimental equipment.

621.397.6

4511 A CONTRIBUTION TO THE PLANNING AND CONSTRUCTION OF TELEVISION OUTSIDE-BROADCAST AND FILM-RECORDING VEHICLES. G.Schadwinkel and H.Klding.

Rdfunktech. Mitt., Vol. 2, No. 6, 277-89 (Dec., 1958). In German.

621.397.6

4512 APPLICATION AND FURTHER DEVELOPMENT OF THE TEST-LINE SYSTEM. H.Springer.

Rdfunktech. Mitt., Vol. 3, No. 1, 40-50 (Feb., 1959). In German.

By means of a newly developed control unit, the white level transmitted in the test lines is used as reference level in order automatically to maintain constant the video input signal of television transmitters. Preliminary investigations had confirmed the suitability of such an "automatic white-level system". The complication caused by the fact that at present the reference signal for white level is transmitted in every second field, has led to a new proposal for the choice and composition of test signals. Accordingly, the white level is to be transmitted in each field at the beginning of the test line. The grey scale and a new test signal for showing frequency response are only to be inserted after the white level. They occur, one in each field, for the remainder of the test lines. During radiation, in order to avoid the test lines becoming visible in domestic receivers, it is furthermore proposed to extend the vertical suppression time in the pulse generator from 21 to 22 lines (C.C.I.R. limits of tolerance) and to move the test lines into the 19th or 20th line after the start of vertical suppression.

621.397.6

4513 METHODS OF BACKGROUND PROJECTION IN TELEVISION. U.Stepputat.

Rdfunktech. Mitt., Vol. 3, No. 6, 266-70 (Dec., 1959).

Discusses various methods of imitating scenery in television (background with large-scale photographs, electronic trick backstage, back-projection of moving or still pictures). Differences between these methods and back-projection for cinema techniques are discussed. A back-projection installation using large transparencies specially developed for television is described. Some technical data of this equipment are given. Recommendations for the practical use of back-projection are given.

621.397.6

4514 THE STATE OF DEVELOPMENT AND POSSIBLE FIELDS OF APPLICATION OF THE AMPEX SYSTEM OF MAGNETIC RECORDING OF TELEVISION SIGNALS. H.J.v.Braunmühl.

Rdfunktech. Mitt., Vol. 3, No. 2, 61-5 (April, 1959). In German.

Discusses in quantitative terms the performance of the Ampex system, after modification for European 625-lines standards, and compares them as far as possible with the corresponding figures for 16 mm-film. Mention is made of the fields of application of television tape recording, which are at present of particular interest to the German television service, and the further outlook for the future is given. A comparison is made of the present operating costs of recording both on tape and on film.

621.397.61

4515 INVESTIGATIONS OF THE OPERATION OF TELEVISION TRANSMITTERS WITH PRECISION OFFSET OF CARRIER FREQUENCY. H.Hopf.

Rdfunktech. Mitt., Vol. 2, No. 6, 265-76 (Dec., 1958). In German.

It is shown that by reducing the frequency tolerance of the transmitter to about ±2.5 c/s the utilization of the fine structure of the offset curve becomes possible, with the result that an improvement by more than 10 dB of the radio-frequency protection ratio is obtained. A number of measured fine-structure curves is discussed, followed by a detailed description of the origin of the interference patterns. The investigation concludes with the measurement of the entire offset curve up to about 1.5 times the line frequency, where the reference interference ratio used has the value of 30 dB recommended by the C.C.I.R., with 2/3 line offset.

621.397.61

4516 HIGH-POWER TELEVISION TRANSMITTER FOR BANDS IV/V (HAARDTKOPF). A.Kolarz and A.Schweisthal.

Rdfunktech. Mitt., Vol. 3, No. 1, 29-39 (Feb., 1959). In German.

Describes, with block diagram and illustrations, the equipment developed by the Sudwestfunk, Baden-Baden, for the Haardtkopf station. A new type of 4-cavity klystron amplifier is being designed to give picture-signal output powers of 10 or 20 kW, a 3-cavity klystron being used in the initial development work. Some details are given of the s.s.b. i.f. amplifier stage, the 18 kV rectifier unit, the stabilizing and control equipment, and the aerial system and cooling arrangements. The station is at first being used as a converter station operating on 38.9 Mc/s and acting as a satellite of the Koblenz television station. It is designed for umanned automatic operation, but will also, at a later date, itself feed other small converter stations. A.Wilkinson

621.397.61 : 621.317.34

4517 OSCILLOGRAPHIC RECORDING OF THE NON-LINEAR PART OF THE PHASE CHARACTERISTIC. L.A.Wegner.
Rdfunktech. Mitt., Vol. 3, No. 3, 114-22 (June, 1959). In German.

Reports upon a new measuring method which makes it possible to record the so-called differential phase characteristic, that is to say, the difference between the actual and the intended linear phase characteristic as a function of frequency. The representation corresponds to discrete, equidistant points on the frequency axis and is obtained by suitably recording the phase characteristic, which is measured continuously. Examples of measurements made on video- and carrier-frequency networks at frequencies between 0.1 and 6 Mc/s are given. The apparatus available made it possible to measure the differential phase characteristic for reference propagation times of 0.2 to 20 μs with a wobble period of 0.5 c/s and a maximum error of 5%, according to the recording range. When the phase scale was adjusted to the maximum, a phase change of 1.8° produced a deflection of the trace on the oscilloscope screen of 1 cm.

621.397.611

4518 TELEVISION INTERMEDIATE-FREQUENCY TRANSMITTERS FOR LABORATORY USE. P.Kiopf.
Rdfunktech. Mitt.,Vol. 2, No. 6, 253-64 (Dec., 1958). In German.

Describes a television modulator for laboratory measurements and tests in connection with the residual-sideband transmission systems for the 625 line C.C.I.R. standard. The transmitter operates with suppressor-grid modulation and gives about 1.5 V into 60 Ω (peak voltage of synchronization pulses), the vision voltage requirement being from 0.5 to 1.4 V peak-to-peak (picture, blanking and synchronization signals). Properties of the modulator are shown by means of test results. Transmission quality via the modulator and an intermediate-frequency standard receiver is discussed by means of test signals, test patterns and a half-tone picture.

621.397.611

4519 A SIMPLE PULSE GENERATOR AND A PULSE DISTRIBUTOR EMPLOYING TRANSISTORS.
H.Stierhof.
Rdfunktech. Mitt., Vol. 3, No. 2, 81-90 (April, 1959). In German.

Describes first the function and behaviour of some basic circuits used in pulse techniques. A simple pulse generator is constructed which produces horizontal and vertical pulses, as well as the blanking signal. The signals are at −4 V in 75 Ω, corresponding to the C.C.I.R. standard. By using suitable high-frequency transistors, it is possible considerably to improve the shape of all of the output pulses, compared with the earlier model, the specified values of 0.2 to 0.4 μs being maintained for the rise- and fall-times. A pulse distributor with six outputs, each of −4 V in 75 Ω, is also described.

621.397.611

4520 A NEW TECHNIQUE FOR EVALUATING THE RESOLUTION OF TELEVISION CAMERA TUBES.
Ya.A.Ryftin and M.V.Antipin.
Zh. tekh. Fiz., Vol. 29, No. 2, 252-60 (Feb., 1959). In Russian.
English translation in: Soviet Physics—Technical Physics (New York), Vol. 4, No. 2, 219-28 (Feb., 1959).

The present method using test-cards with wedge-shaped lines is critically discussed; it is proposed that instead the number of raster lines be adjusted until "fully valid" scanning occurs, i.e. the full scanning achieved by a Nipkow disc, for example; a test-card including Fresnel patterns to measure this number is described and some results are given. B.Meltzer

621.397.611

4521 THE DESIGN OF A 4½-INCH IMAGE-ORTHICON CAMERA CHANNEL. G.E.Partington.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 2, 92-8 (Feb., 1960).

The apparatus, which includes associated units as well as the camera, constitutes an advance on an earlier similar equipment. Numerous changes have been made, aimed mainly at weight reduction, simplicity of control, accessibility and easy replacement. The description covers the turret and focusing technique, temperature control of the camera tube, exposure control, viewfinder (a 7 in. rectangular kinescope), cables and audio monitoring. The equipment external to the camera includes four units, a power unit, camera control unit, control panel and picture and waveform monitor. Printed circuits are widely used. The electrical performance, operating technique and stability and requisite staging and lighting are also discussed. H.G.M.Spratt

621.397.62 : 621.396.662

TRANSISTORIZED TUNERS FOR PORTABLE TELEVISION.
See Abstr. 4445

621.397.621 : 621.396.67

4522 THE IMPEDANCE MATCHING OF JUNCTIONS BETWEEN AERIAL AND FEEDER AND FEEDER AND RECEIVER FOR TELEVISION. H.Mertens.
Bull. Soc. Roy. Belge Elect., Vol. 75, No. 4, 297-304 (Oct.-Dec., 1959). In French.

An account is given of the effects of standing waves on transmission lines. Lack of matching can result in a loss of input signal at the receiver and the presence of ghost images. Descriptions are given of a shunt stub matching section and a balancing unit of the half-wave type. W.T.Blackband

621.397.621

4523 PRINTED CIRCUIT PRODUCTION FOR A TELEVISION TUNER. P.C.Ganderton.
J. Brit. Instn Radio Engrs, Vol. 20, No. 4, 290-2 (April, 1960).

The use of printed circuit techniques in the main chassis and coils of a turret tuner has lead to a far greater degree of consistency of production than with wired tuners. The method of preparing the basic etched circuit, its subsequent assembly, dip soldering and cleaning are described.

621.397.74

4524 METHODS FOR PLANNING OPTIMUM TELEVISION TRANSMITTER NETWORKS FOR BANDS IV AND V [DESCRIPTION OF THE METHODS AND INDICATIONS FOR USE]
H.Eden, H.W.Fastert and K.H.Kaltbeitzer.
Rdfunktech. Mitt., Vol. 4, No. 1, 4-22 (Feb., 1960). In German.

Describes in detail methods for determining optimum transmitter networks and channel distributions and illustrates them by means of tables. It is endeavoured to attain distributions which involve the smallest possible interference within the network. An exclusive study is made of a linear channel distribution that can be expressed by a triad and in which all network points are of equal value. The determination of suitable triads and optimum measurements of the elementary triangle sides are also described. The method may be used in the design of networks involving transmitters of the same or even of different e.r.p. In addition, it is suitable for designing transmitter networks incorporating different delevision standards, provided a number of additional requirements are taken into consideration. When translating it into practice, in order to transfer the the regular network that has been established to the actual geographical network of transmitting stations, the calculated network is distorted. Any infringement of the minimum distances that may occur in that process may be subsequently corrected by suitable modification of the radiated power.

621.397.743

4525 PLANNING FUNDAMENTALS FOR TELEVISION TRANSMISSION NETWORKS IN THE BROADCASTING BANDS IV/V. H.Fleischer and W.Berndts.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 11, 554-60 (Nov., 1959). In German.

A general discussion of the various factors that must be considered in designing a system giving signals of good fieldstrength and picture quality over the whole of an extensive terrain. The factors considered include the number and location of transmitter and repeater stations, transmitter power and frequency, aerial height and gain, the higher noise figure of receivers for bands IV and V, and the flat, hilly or mountainous character of the terrain. 12 references to relevant publications. A.Wilkinson

621.397.9

4526 UNDERWATER TV EQUIPMENT. K.Schultz.
V.D.I. Z., Vol. 102, No. 9, 339-46 (March 21, 1960). In German.

An engineering and historical survey of underwater television since 1947 is presented, illustrated by numerous photographs and diagrams. A modern German equipment is described in detail, with particular emphasis on special auxiliary devices like automatic photo-cell operated control for depth indication and course maintenance, various safety arrangements and optical and lighting equipment. An extensive bibliography is quoted. A.Landman

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-5

4527 THE PROBLEM OF EQUIVALENCE OF PULSE AND CONTINUOUS CONTROL SYSTEMS. V.A.Rubtsov.
Avtomat. i Telemekh., Vol. 19, No. 10, 945-52 (1958). In Russian.

The insufficiency of the common equivalence criterion for pulse and continuous control systems is proved and conditions for the equivalence of closed-loop control systems are determined.

621-52

4528 CALCULATION OF TRANSIENT PROCESS IN COORDINATED CONTROL SYSTEMS. N.L.Raikhel'.
Avtomat. i Telemekh., Vol. 19, No. 11, 1016-26 (1958). In Russian.

621-52

4529 LOGARITHMIC METHOD OF PLOTTING THE REAL FREQUENCY RESPONSE CHARACTERISTIC OF AUTOMATIC CONTROL SYSTEM. V.A.Atsyukovskii.
Avtomat i Telemekh., Vol. 19, No. 11, 1073-6 (1958). In Russian.

621-52

4530 USING THE ROOT LOCUS. I-II. T.Jawor.
Control Engng, Vol. 6, No. 10, 96-102 (Oct.); Vol. 6, No. 11, 119-22 (Nov., 1959).

Describes construction of root-locus diagrams and their use in closed-loop stability analysis. Part II shows how to calculate step- and transient-response characteristics from the locus curve, and how to apply the method to multiloop systems.

621-52

4531 PERFORMANCE CRITERIA FOR CONTROL SYSTEMS. A.T.Fuller.
J. Electronics and Control, Vol. 7, No. 5, 456-62 (Nov., 1959).

It is shown that settling time and integral-square-error, although at first sight quite different concepts, are closely related. For ordinary random inputs (i.e. inputs such that the error E is a stationary random function of time t), it is usual to adopt the mean-square-error E^2 as the performance criterion. This is the analogue of integral-square-error for simple transient inputs. A performance criterion for ordinary random inputs is introduced which is an analogue of settling time for simple transient inputs. It is also shown that this new criterion and the E^2 criterion are closely related, both being members of a simple general class.

621-52

4532 A SPECIAL PHENOMENON IN SOME PULSE SYSTEMS. J.Tschauner.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 9, 456-8 (Sept., 1959). In German.

The class of closed-loop systems considered is that in which the input signals are pulses and the output has steps. The transfer function has polynomial numerator and denominator of the same degree. An example is analysed and the relationship between permissible gain and the ratio of the two time-constants is shown. Calculated responses for various values of time-constant ratio and gain are compared with measured responses and show good agreement. W.G.Stripp

621-52

4533 THE MUTUAL INFLUENCE OF THE CONTROLLED VARIABLES IN MULTIPLE CONTROL-LOOP SYSTEMS. R.Starkermann.
Regelungstechnik, Vol. 7, No. 9, 301-6 (Sept., 1959).

The stability of a system containing a dual control loop is investigated with the help of a simple example. This represents a simple case selected from the wide field of systems with multiple control loops. These consist of a number of idealized proportional controllers, each feeding one regulating unit, so that mutual coupling between the control loops can take place only within the controlled plant. The system stability is determined for a specified amount of coupling in the controlled plant.

621-52

4534 TRANSFER CHARACTERISTICS OF CONTROL SYSTEMS FOR TIME-DEPENDENT DISTURBANCES. K.Lichtblau.
Regelungstechnik, Vol. 7, No. 9, 306-10 (Sept., 1959). In German.

Control system characteristics can be more easily calculated if the disturbances are assumed not to be of a step nature but to be time-dependent. Such calculations are more useful for practical applications and are of greater general validity and more representative. This is illustrated by an example dealing with linear disturbances.

621-52

4535 CRITERION FOR THE EXISTENCE OF MULTIPLE ROOTS OR OF AN EVEN OR ODD NUMBER OF CONJUGATE COMPLEX PAIR OF ROOTS IN ALGEBRAIC EQUATIONS. R.Hofmann.
Regelungstechnik, Vol. 7, No. 9, 310-12 (Sept., 1959). In German.

It is shown how, for rational polynomials, the square of the product of the differences of the roots can be obtained closed by means of the coefficients. This product gives a clue to the existence of at least one multiple root and it also indicates whether the number of conjugate complex pairs of roots is even or odd.

621-52

4536 MIXED TRANSCENDENTAL AND POLYNOMIAL TRANSFORMS. O.J.M.Smith.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 786-95 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

In networks and control systems, exponential terms arise due to diffusion in a transistor, or to various forms of dead-time. Substitution of an exponential variable y for s facilitates manipulations of the transforms and location of zero and poles. If a transmission line is connected in feedback in a pulse system, an infinite series of pulses can be generated. This leads to an infinite column of poles in the s plane and a change of variable into the y or z plane is desirable ($z=-1/y$). An infinite column of poles in the s plane becomes a single pole in the y plane. Several systems of cascaded and parallel transmission lines are examined to show the methods involved. An example of a mixed response arises in a time-constant cascaded with dead time. Two complex-frequency planes are needed to represent this system with a finite number of poles and zeros. One must be the s plane and the other can be the y or z plane. The example is trival but the method is efficient and practical for more complex systems. A form of control called a Posicast is studied. This has a delay-line compensator prior to a lumped parameter system, and forms a deadbeat system. The correct design is that in which, for each pole in the lumped-parameter system, there is a coincident zero generated by the compensator. The resultant S-function has only zeros in the finite S plane. The system has significant advantages over Chebyshev or Butterworth designs in that gain is more uniform in the bandwidth. The method of evaluating the root locus and the residues at the poles is also used for the system consisting of a delay line with feedback, followed by a lumped-parameter system with feedback. The impulse and step response may be written down from graphical evaluations. W.G.Stripp

621-52 : 621.375.23

4537 TRANSIENT RESPONSE AND THE STABILIZATION OF FEEDBACK AMPLIFIERS. J.H.Mulligan, Jr.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 495-503 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

It is possible to formulate a stabilization design criterion for feedback amplifiers based on direct control of the transient response rather than phase and gain margins (see Abstr. 3355 of 1949). The design criterion suggested, the damping rate of attenuation of the dominant time term in the step-junction response, is a simple function of the pole angle of the dominant pair of complex poles and is also related to the maximum transient overshoot.

J.MacCormack

621-52 : 621.396.965.8

4538 AN APPROACH TO THE STUDY OF AUTOMATIC TARGET TRACKING. L.Pode.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 806-11 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

The problem of prediction of future target position from

previous information is treated on a statistical basis. The minimum amount of information to be retained for efficiency, and the narrowness of the gate necessary in the presence of other targets are considered. The limitations of the prediction accuracy due to target manoeuvre and errors in stored information are stated.

T.Horrocks

621-52

4539 A NUMERICAL PROGRAMMING CONTROL SYSTEM FOR A HEAVY LATHE.

I.L.Shapiro, E.M.Grossman, Yu.A.Raisov and Yu.V.Tikhvinskii.
Elektrichestvo, 1960, No. 2, 9-12 (Feb.). In Russian.

A description is given of a numerical programming control system for a lathe capable of handling articles weighing up to 10 tons. The machining tolerance for these articles is up to 0.1 mm and the feed rate is 5 to 200 mm/min. Use is made of intermediate recording of the programme on magnetic tape and the apparatus is used for several lathes. A laboratory test on a model showed that the control system can be used for heavy lathes but actual industrial use will be necessary to confirm this result.

Associated Electrical Industries (Manchester)

621-52 : 621.365

4540 USE OF MODERN MEASURING AND CONTROL EQUIPMENT IN THE IRON AND STEEL INDUSTRY.

A.Högn.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 76, No. 23, 583-93 (Dec., 1959). In German.

It is shown by a number of examples to what extent the technical problems of the means of production (e.g. industrial furnaces) and their operation, influence the design of measuring and control equipment. Amongst these examples the control of air heaters for blast furnaces, the hearth-pressure control in Siemens-Martin furnaces, the control of cruicible furnaces with pure-oxygen-blown metal-surface, the waste-heat boilers for such furnaces, the control of deep furnaces for rolling mills and of billet reheating furnaces are described in detail and illustrated. A brief section deals with the economy of such measuring and control equipment, and the trend of its development is discussed especially as regards the part electronic brains will play in the automation of such equipment.

R.Neumann

621-526

4541 ON THE LIMIT VELOCITY OF SERVO SYSTEMS WITH POWER, TORQUE AND VELOCITY LIMITATION.

E.A.Rozenman.
Avtomat. i Telemekh., Vol. 19, No. 7, 633-53 (1958). In Russian.
English summary: PB 141096T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The problem of the shortest possible transient disturbance in the output under the conditions stated in the title is considered. The character of the transient is determined by phase-plane plots. As a result of application of the calculus of variations the optimum form of the transient is determined and the phase-plane is divided into regions accordingly. The output stage (assumed to be a motor) is considered in terms of the motor current, the natural frequency and the motor time-constant. The effect of the limitations, individually and collectively, is investigated.

T.Horrocks

621-526

4542 DETERMINATION OF THE LIMIT OF THE STABLE DOMAIN IN PARAMETRIC SPACE. M.A.Ajzerman.
Automatisme, Vol. 5, No. 3, 102-9 (March, 1960). In French.

A translation of an extract from a book in Russian by the author. This is the first of a series introducing the basic concepts of control engineering as used in Russia. A concept of parametric space is introduced in which the characteristic equation of the system under consideration is solved for one or more parameters. In case of one parameter an assumption is made that the parameter is complex, and a complex-plane solution is plotted. Otherwise, for real parameters, a two- or n-dimensional solution is obtained. Since the solution is obtained from the characteristic equation the parametric space is divided by the solution into stable and unstable regions. Some simple examples are given.

T.Horrocks

621-526

4543 ALIGNING SERVO LOOPS WITHOUT PRECISION SYNCHROS. D.G.Kingsborough and D.H.Swindell.
Electronics, Vol. 33, No. 12, 84-5 (March 18, 1960).

The method applies to synchro-control transformers. A null is obtained in the rotor circuit at every odd multiple of 30° if an a.c. signal is applied to any two stator leads, and similarly, at every even multiple if two stator leads are joined and a.c. is applied between the common star point, and the remaining lead. The method eliminates errors due to different voltage magnitudes being applied to separate windings as in conventional tests. Circuits of the various interconnections are given.

K.C.Garner

621-526

4544 A NEW APPROACH TO THE LINEAR DESIGN AND ANALYSIS OF PHASE-LOCKED LOOPS. C.S.Weaver.
I.R.E. Trans Space Electronics and Telemetry, Vol. SET-5, No. 4, 166-78 (Dec., 1959).

Using the techniques and philosophy of control systems theory, the phase-locked loop is analysed as a conventional feedback loop. The root-locus method yields graphs which specify how the transient response changes with signal strength. This method also reveales two thresholds which explain why a small change in signal strength or modulation may cause complete loss of detection. Charts show how the transients vary with various pole–zero patterns for both step and ramp inputs. The feedback equation shows why the phase-locked loop is an f.m. detector, and simplifies its design analysis to that of a simple audio network. The application of Wiener's criterion is simplified, and a new method of solution for the filter is presented which is applicable to almost any kind of signal. Because the phase-locked loop is nonlinear, there is no known solution for the filter except when the noise is white. The optimum transfer function may easily be reduced to the loop components. When used in an a.m. detector the phase-locked loop should be designed for minimum phase-shift independent of the modulation.

621-526

4545 ANALYSIS OF NONLINEAR SAMPLED-DATA CONTROL SYSTEMS. I-II. E.Kinnen and J.Tou.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 386-90, 390-4 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

Both papers describe the applications of numerical methods of analysis to sampled-data systems. In Part I, systems containing the nonlinearity between the sampler and the linear element are considered. In Part II the nonlinearity is considered to occur between two linear elements. Nonlinearities considered are; dead-zone, limiting, and hysteresis. The linear elements include the transport delay. Some block diagram manipulation is a feature of the method given in Part II. The method is not amenable to systems having stochastic inputs.

K.C.Garner

621-526

4546 DUAL-MODE RELAY SERVOS.
R.N.Buland and N.Furumoto.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 405-11 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

An analysis and design procedure are given for a type of relay servo which operates with a quasi-linear performance for small error signals, and with a "bang-bang" mode for large errors. The main feature is the use of a linear feedback network round the relay. Analytical design methods are relatively easy providing the order of the system is three or below. An example is given with simulator results for comparison.

K.C.Garner

621-526

4547 APPLICATION OF SWITCHING TRANSISTORS AND SATURABLE REACTORS IN A HIGH-PERFORMANCE SERVO. F.B.Cox and P.R.Johannessen.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 466-74 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

Objections raised so far against instrument servos using magnetic devices are that they require very often to use thermionic input stages and that the push-pull output circuit dissipates power even when the error signal is zero. A design is described in which the input amplifier uses transistors and the magnetic amplifier is designed to furnish current pulses, the widths of which are proportional to the control signal, to the bases of power transistors. Because current flows in the output transistors only when an error signal appears in the loop the efficiency of the power stage is enhanced and heating in the motor winding is kept to a minimum. The supply to the magnetic amplifier is a 5 kc/s square wave. The instrument controlled is a 400 c/s two-phase motor. Minor-loop feedback from an a.c. tachometer is used to achieve a maximum bandwidth. To obtain a high velocity-constant the tachometer is effectively decoupled from the system for constant motor speeds by

a high-pass filter in the feedback loop. A bandpass filter is avoided at this point by demodulating the feedback signal prior to filtering by a keyed, phase-sensitive magnetic demodulator. The theory shows good agreement with experiments on a Kearfott type R801-1A-A two-phase machine. S.C.Dunn

621-526

4548 A METHOD FOR THE SYMBOLIC REPRESENTATION AND ANALYSIS OF LINEAR PERIODIC FEEDBACK SYSTEMS. E.O.Gilbert.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 512-23 (1959) = Applic. and Industr., No. 46 (Jan., 1960).

An extension of methods used for sampled-data systems is developed. A unified method of approach for systems with periodic variation of signal by multiplication by a train of periodic pulses, systems with finite pulse-clamped error signal and the more general case of piecewise constant variation of parameters is derived. The methods of symbolism and analysis presented in the paper treat systems with any combination of the described periodic variations. A state vector defining the system and input behaviour at all times is used. Solution of the equations defining this vector is accomplished by matrix methods. The Z-transformation is used to obtain the solution at the fundamental time intervals nT. The methods are illustrated with examples. T.Horrocks

621-526

4549 DIGITAL CONTROL OF MACHINE TOOLS. A.G.Thomas.
Electronics, Vol. 33, No. 11, 174-6 (March 11, 1960).

A stepping-motor (step = $6\frac{2}{3}$ deg) controlled by a reversible thyratron ring-of-3 is used for each required milling-machine motion. The programme tape has 2 channels per axis, one indicating one step in the + ve direction, the other a reverse step. A.O.Stanesby

TELECONTROL . TELEMETERING

621.398

4550 COMPARATIVE MERITS OF ANALOG AND DIGITAL TELEMETERING. L.C.Watson and M.Goldstein.
National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 14-24.

The relative performance of various primary modulation modes are discussed and particular emphasis is placed on pulse-code modulation. It is assumed that an accuracy of ± 0.5% is required, that there are 18 channels and the threshold for an f.m. receiver is 9 dB. The four systems are f.m., p.d.m., p.a.m. and p.c.m. The basic advantage of the p.c.m. system is that bandwidth may be traded for signal–noise ratio. In comparing f.m. and p.c.m. it is shown that as the bandwidth increases there is a greater improvement in p.c.m. signal–noise ratio. In p.c.m., once the signal is above the threshold the output s.n.r. cannot be improved further by increasing signal strength; this is due to presence of quantization noise which can only be reduced by increasing bandwidth. P.C.M. requires the minimum r.f. bandwidth and the signal power required shows an 8.8 dB improvement over f.m. and 5.9 and 6.0 dB respectively over p.a.m. and p.d.m. In the f.m. system the carrier deviation is assumed to be 125 kc/s. The present objection to p.c.m. is based more on hardware than on theoretical advantages; it is suggested that the advent of microminiaturization circuitry will radically alter this situation. S.C.Dunn

621.398

4551 THE INFLUENCE OF F.M.–F.M. TELEMETRY COMPONENT CHARACTERISTICS ON SYSTEM PERFORMANCE. O.J.Ott.
National Telemetering Conference, Denver, Colorado, 1959. (See Abstr. 4929 of 1959) p. 31-9.

A major distinction can be drawn between the inaccuracies of transmission of data by means of time-division and frequency-division multiplex systems in the presence of noise. Although both systems are subject to both static and dynamic errors the frequency-division system can sustain dynamic errors without introducing static inaccuracy, while the time division system cannot do this, or only rather exceptionally. On the other hand the control or correction of static error introduced by encoding or decoding apparatus is more difficult in the frequency-division system. The major errors in a typical f.m.–f.m. system are caused in four main groups: sub-carrier oscillator; transmission link; storage; decoder. It is apparent that in most systems the intelligence components in sub-carrier oscillator output are more significant causes of error than harmonic content. The use of filters and limiters is briefly discussed. S.C.Dunn

621.398

4552 DISTORTION IN F.M.–F.M. SYSTEMS AND ITS EFFECT ON SYSTEM ACCURACY. W.O.Frost.
National Telemetering Conference, Denver, Colorado, 1959. (See Abstr. 4929 of 1959) p. 45-52.

The treatment is qualitative. The most troublesome sources of noise and distortion are: intermodulation distortion due to non-linearities in the system; harmonic distortion in the sub-carrier oscillator outputs, data feed-through distortion in the sub-carrier oscillators; power supply effects. A number of graphs are presented showing typical measurements and effects due to these sources and some information is given on the AN/DKT-8(OX-4) telemetry transmitting set. This is a 17-channel system with provision for p.a.m. commutation at 10 rev/sec on either one or two sub-carrier channels. The set was designed for general missile application and a major design consideration was to achieve minimum practical overall distortion level. Peak distortion observed at the channel outputs varied from 0.15% for the lower frequency channels to about 0.85% for the 70 kc/s channel. It is stated that these represent the limit of performance of this type of telemetry set at the present state of the art. S.C.Dunn

621.398

4553 ACCURACY AND RELIABILITY OF THE SANDIA 220 MC TELEMETRY SYSTEM. J.H.Scott.
National Telemetering Conference, Denver, Colorado, 1959. (See Abstr. 4929 of 1959) p. 53-66.

The system is basically an f.m.–f.m. frequency-division multiplex with p.a.m. on sub-carriers. The relative times of occurrences at impact are measured using an a.m.–f.m. sub-system called MOD-6. The results are presented of a study into the accuracy and reliability of the system in such a way as to include the human element. It is concluded that the amplitude inaccuracy is 5% (2 sigma) and that the equivalent reliability on flight testing is 90%; the relative time inaccuracy of the MOD-6 sub-system is within the desired limit of 15 μs. The particular features of the system, which are discussed with relevant graphs and charts, are: noise; voltage measurement; sub-carrier time delay; measurements of pressure, acceleration, temperature and vibration. The standard deviation for the 3V calibration voltage was calculated to be 1.92%. The inaccuracy for pressure measurement was estimated to be 0.3% full scale. The information on vibration is sent on three channels and these showed amplitude agreement within ± 10%. S.C.Dunn

621.398

4554 SOME CONSIDERATIONS OF THE EFFECTS OF NUCLEAR RADIATION ENVIRONMENTS ON PRECISION AIRBORNE INSTRUMENTATION. J.M.Rau, Jr.
National Telemetering Conference, Denver, Colorado, 1959. (See Abstr. 4929 of 1959) p. 67-77.

Two main fields of operation are envisaged: manned missions lasting 250 days in which the ambient radiation could lie between 10^{10} and 10^{13} neutrons/cm^2 sec; missile flights in which the shielding is reduced and the flux intensity might be 10^{15} to 10^{20} neutrons/cm^2 sec but for shorter periods of time. Three main problems are: the deteriorations of materials resulting in a change of structural strength or in electrical properties; high temperatures induced by radiation; high acceleration as a result of high-performance rockets. It is concluded that the more complicated instruments operating at low levels and those involving oscillatory motion seem to be forbidden. Normal electronic components are likewise unacceptable and the favoured solution to problems are simple electromechanical devices. It is suggested that in many instances there will be only one design approach and one constructional material which can be used and the resulting performance will just have to be accepted. Tables are given of the relationship among radiation units, the radiation sensitivity of mechanical properties of materials, and the forecast of the state of the art for nuclear environmetal instruments in 1961. S.C.Dunn

621.398 : 621.373.52

4555 VARIABLE INDUCTANCE MODULATION OF A TRANSISTORIZED SUB-CARRIER OSCILLATOR. C.E.Land.
National Telemetering Conference, Denver, Colorado, 1959. (See

Abstr. 4929 of 1959) p. 78-102.

The inherent non-linearity of a variable-inductance modulated oscillator has until recently prevented its use as a sub-carrier oscillator in f.m.–f.m. telemetry systems. The development of a method for obtaining linear operation of a variable-inductance-modulated oscillator has led to its application to the design of a complete line of subcarrier oscillators. The oscillator is essentially a series resonant circuit and a transistor switch. The frequency of oscillation is modulated by varying the impedance of the coil connected in a series resonant circuit. The inductance variation is caused by applying a direct field to the ferrite material of the core. Three versions are described: a voltage-controlled oscillator, current-controlled and thermocouple-controlled. The core material is Ferramic type O3. Frequency drift has been held to within ±3% bandwidth over a temperature range -30 to +80° C. Over the same range the variation in linearity and sensitivity was less than 1% of bandwidth. S.C.Dunn

621.398

4556 A SOLID STATE MULTIPLEXER AND P.C.M. ENCODER. T.P.Bothwell, R.C.Baron and R.J.Sutherby.

National Telemetering Conference, Denver, Colorado, 1959. (See Abstr. 4929 of 1959) p. 103-12.

The specified items described are a 20-channel electronic commutator and a 13-bit analogue–digital encoder. The design is intended for operation from 10° to 45° C; the combination is capable of converting 10^4 analogue samples/sec into p.c.m. pulse transmission with an overall accuracy of better than ±0.075% of the ±10V full-scale input. The coder presents both serial and parallel outputs. A feature of the serial output which particularly suits the coder to p.c.m. telemetry and transmission systems is its capability to synchronize its serial output to an external clock at any rate up to 200 kc/s. Sample-and-hold circuitry may be added with an increased uncertainty of 0.02%. S.C.Dunn

621.398

4557 VOLTAGE-TRANSFER LOW-LEVEL COMMUTATION SYSTEM. M.E.Martin and W.M Phillips.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 161-7.

In the design of low-level commutation systems the rejection of common-mode signals is often a primary consideration. The voltage-transfer system achieves a high degree of common-mode signal rejection by charging a capacitor from a signal source and then switching the charged capacitor to the input of a low-level amplifier. To restore the reference level and eliminate the drift commonly encountered in d.c. amplifiers, the amplifier is RC coupled and clamped at the output. The major design problem is the development of a commutator which will perform the necessary switching operations. It is concluded that a 4-pole sliding-contact commutator is inconvenient and that a magnetically actuated sampling switch seems to offer the greatest promise. The latter type of switch only operates satisfactorily at higher sampling rates. A separate capacitor would be required for each channel. It is estimated that the maximum noise introduced by the commutator would be less than 10 μV and the common-mode rejection ratio could be 3×10^5 to 1. S.C.Dunn

621.398 : 621.318.56

4558 A LOW-LEVEL, HIGH-SPEED SAMPLING SWITCH. E.J.Young.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 176-80.

Briefly describes a magnetically-actuated sampling switch with an expected life exceeding 2×10^8 operations. It is concluded that the common-mode rejection ratio of 10^8 to 1 would be achievable if a flying capacitor value of 3 μF was used. The mechanism is oil-filled and contacts are of a gold alloy. The natural period of the armature and contact is approximately 100 μs. The switched current was intended to be 1 mA but values up to 20 mA have been switched with no observable damage. Ten units have been run to 7.5×10^8 operations at 1 V and 1 mA with no failures. Both single- and double-pole configurations are possible. S.C.Dunn

621.398 : 621.395.625.3

4559 HIGH DENSITY MAGNETIC TAPE RECORDING OF DIGITAL DATA. M.A.Wells.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 188-205.

The tape system described is a major component of a high-speed digital data handling system (see following abstract). The airborne tape recorder accepts the output of the analogue–digital convertor in the form of an 11 bit per word plus parity and event information which is received in parallel form on 1 inch magnetic tape. Up to 55 000 words/sec. can be received. A completely new type of transport system is described which is capable of handling 14 in diameter tape spools under severe environmental conditions with a minimum amount of tape skew. A ground-based recorder–reproducer accepts the output telemetry receiver after its conversion to parallel form, and produces a duplicate of the airborne tape. The output is then edited and re-recorded on an I.B.M. 727 recorder in a computer-compatible format. All of the bits making up each work are recorded simultaneously in a line across the width of the tape using non-return-to-zero digital recording. As a consequence of mechanical and electrical aberration the bits of each word are not recovered at exactly the same time during playback, hence it must all be aligned in time before the information can be used. Inter-track time displacement is the primary factor which places an upper limit on the number of bits per linear inch which can be recorded reliably. Present experience indicates that recording densities up to 32 000 bits/in² of tape can be achieved at rates up to 880 000 bits/sec. There are 16 tracks each 0.025 in. wide pitched at 0.061 in. The gap length in the writing and reading heads is 0.00025 in. Five speeds are available between 56-2.8 in/sec. Constant tape-speed is maintained by pinching the tape to a rotating capstan which is driven by a hysteresis-synchronous motor operated from a 400 c/s precision source. S.C.Dunn

621.398

4560 A TRAILER-INSTALLED FLIGHT TEST MONITORING AND CONTROL STATION. S.F.Higgins.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 219-31.

The telemetry system used in the data acquisition system is designed to operate in the 1435 to 1535 Mc/s band. F.M. is used with a bit-rate variable between 15 and 820 kc/s. The airborne transmitter has a power output of 20 W and has been tested to a range of 115 miles at an elevation of 10 000 feet. The ground station consists of three vehicles; record station, aerial trailer and petrol-driven generator. Serial p.c.m.–f.m. information is received via the telemetry link and is converted to parallel form by a serial-to-parallel convertor. When synchronization is obtained by the identification of a unique character in the word structure, a reset and transfer circuit is operated which transfers the data to a data-handling system for simultaneous display and recording on magnetic tape. Up to 20 data channels may be displayed simultaneously. The receiving aerial has a cosec^2 pattern in the vertical axis with a beamwidth of approximately 20° and a gain of 26 dB. The receiver is a cavity-tuned superheterodyne with a noise figure of 8 dB. The video output peak-signal-to-noise was measured at 28.5 dB. Receiver bandwidth is 10 Mc/s: output is ±10 V into 2.7 kΩ load. The hardware is organized wherever possible into modular groups. The tape equipment is described in the preceding abstract. Voice radio equipment is provided to maintain communication between the central control facilities and the manned vehicle. S.C.Dunn

621.398

4561 PROCESSING AND PRESENTATION OF DATA FROM OUTER SPACE. I. PIONEER PROBE. J.M.Seehof and B.W.Washburn.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 232-43.

The probe included instrumentation to measure: magnetic-field intensity, micrometeorite impact rate, radiation field intensity, payload temperature. The magnetometer consisted of a rugged search coil and nonlinear amplifier to convert a wide dynamic range of field-strengths. The vehicle rotated at approximately 2 revs/sec causing amplitude-modulation of the output signal. The micrometeorite detection system consisted of a diaphragm and microphone used as a detector, a 3-stage bandpass amplifier and logical circuitry. A low-momentum particle impacting on the diaphragm gave rise to a single change in voltage level from the more sensitive channel only; high momentum particles gave rise to a detectable output from both diaphragm and microphone channels. Radiation was measured in two ways: using an ion chamber giving the best appreciation of the biological effects of penetration radiation; a proportional counter telescope consisting of seven tubes arranged concentrically about one of them. Two thermometers were included, one a thermistor, the resistance of which controlled the frequency of a sub-carrier oscillator. The second was an electronic circuit

whose output varied with temperature. Pioneer I carried a completely transistorized 300 mW transmitter operating at 108.06 Mc/s Pioneer II carried in addition a 100 mW transistor operating at 108.09 Mc/s. Both transmitters were phase-modulated by the composite sub-carrier signal; the design was such that the r.m.s. value of the phase deviation should not exceed 30°. The 300 mW transmitter on Pioneer I also served as the return link of a 2-way coherent Doppler system which was used both for determining the radial velocity of the vehicle and to communicate with it, with instructions for vernier firing, structure staging and retrorocket firing. A secondary purpose of the link was the measurement of range. The co-operating ground stations were situated in Florida, Hawaii, Singapore, Jodrell Bank and Millstone Hill. The leading particulars of the equipments at these sites is briefly described. The scientific results of these experiments are described at some length. S C.Dunn

621.398

4562 SERVO-COMPENSATED POWER-TO-DIRECT-CURRENT TRANSDUCER FOR TELEMETRY. M.Duma and M.Strbu.
Automatica si Electronica, Vol. 3, No. 3, 119-26 (May-June, 1959). In Roumanian.

Such devices are useful for remote monitoring of power levels in electricity networks and power stations. A circuit is described in which the torque produced by a type of wattmeter is compensated by an equal and opposite torque produced in an error-cancelling servo-amplifier: the latter gives a d.c. output equivalent to measured power within a max. tolerance of ± 1% and with a 2 sec. time constant. Standard circuit components are used and useful operating ranges up to 40 km, without the aid of repeaters, are realized. Theory, circuit description and 8 illustrations are given. 7 references. A.Reiss

621.398

4563 CODERS AND DECODERS PULSE-CODE TELEMETERING SYSTEMS. Ya.A.Kupershmidt.
Avtomat. i Telemekh., Vol. 19, No. 9, 879-91 (1958). In Russian.

621.398

4564 NOISE STABILITY OF PULSE-FREQUENCY TELEMETERING. N.V.Pozin.
Avtomat. i Telemekh., Vol. 19, No. 10, 968-76 (1958). In Russian.

621.398

4565 EFFICIENCY OF USE OF A FREQUENCY BAND IN TELEMETERING. R.R.Vasil'ev.
Avtomat. i Telemekh., Vol. 19, No. 11, 1066-9 (1958). In Russian.

The influence of noise on a telemetered signal is considered for various types of modulation. When the spectrum of the signal is much smaller than the available channel bandwidth, amplitude modulation gives inferior performance to frequency modulation, pulse-frequency modulation, pulse-time modulation and pulse-width modulation. These latter perform approximately equally well. [English summary: PB 141096T-12, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. A.Woroncow

621.398 : 621.318.563

4566 PULSE-OPERATED MULTI-FREQUENCY DEVICES FOR TELECONTROL. F.A.Katkov.
Avtomat. i Telemekh., Vol. 20, No. 1, 54-61 (1959). In Russian.

Principles of signalling and telecontrol by means of frequency-selective relays are described. The relays operate at frequencies of a few hundred cycles/sec, have a bandwidth of a few cycles/sec and are activated by a train of exponentially decaying oscillations. Several schemes, some with check signals, and suitable for working on a common line linking several points for the purposes of signalling or telecontrol are discussed. A.Woroncow

621.398 : 621.317.39

4567 INSTRUMENTATION FOR EXPLORING THE OCEANS. H.E.Edgerton and S.O.Raymond.
Electronics, Vol. 33, No. 15, 62-3 (April 8, 1960).

The apparatus consists of two cylindrical containers strapped together and incorporating two underwater automatic-cycling cameras using 35 mm film, an electronic-flash lighting system and a sonar transmitter. The equipment is battery driven and hence self-contained The cameras take 500 stereoscopic photographs over a period of two hours, the operation being initiated by a time delay switch. Control of the cameras and the flash tube, which is effected by four transistor circuits, is described in detail. The sonar apparatus provides information regarding the distance of the cameras above the sea bed. H.G.M.Spratt

621.398 : 621.317.79

4568 ABLE-3 PAYLOAD DESIGN. J.E.Taber.
I.R.E. Trans Military Electronics, Vol. MIL-3, No. 4, 143-9 (Oct., 1959).

Discusses the Able-3 payload instrumentation. Design parameters and functional characteristics are discussed in terms of the two goals of this programme: to build a payload which gathers as much scientific information as possible concerning the space environment about the earth, and to develop and check communications, power supply, and temperature control systems suitable for subsequent interplanetary space probes. The basic electronics of the satellite and their relationship with the experimental equipment, as well as with structural and other aspects of the satellite, are discussed in some detail. Particular emphasis is placed on the communications system, and, in particular, on the new digital telemetry system and its value to deep space exploration.

621.398 : 621.394.44 : 621.315.052.63

4569 REMOTE OPERATION OF HIGH-VOLTAGE SWITCHGEAR BY MEANS OF CARRIER-FREQUENCY SIGNALS. E.Schumm.
Elektrotech. Z. (E.T.Z.)B, Vol. 11, No. 12, 471-5 (Dec. 21, 1959). In German.

In a distribution network it is possible to avoid duplication of expensive h.v. circuit breakers by employing carrier signals imposed on the supply frequency for the remote operation of the breaker at the generating end in the event of a fault. Equipment which has been developed on "fail-safe" principles so that a failure in the carrier does not lead to the cutting off of power supplies over a wide area is described. Particular care was taken in design to ensure that differentiation between faults and transient interference with the carrier signal, such as is caused by lightning, is obtained. D.R.Way

621.398

4570 CENTRALIZED CONTROL OF RAILWAY TRAFFIC. E.Guillerault.
Rev. gen. Elect., Vol. 69, No. 2, 91-107 (Feb., 1960). In French.

The concept of electrical switch-boxes using initially the principle of directing levers is recalled. The limitations of this method, which makes centralized control difficult and therefore also prevents the full exploitation of the railway network are considered. This leads to the modern type of push-button, "all relay" control. The question of telecontrol of the switch box from a central post is examined. This telecontrol system, using direct current, whether pulsed or not, has given complete satisfaction. It cannot be used however over any distance exceeding some 5 km where the railway is electrified and using single-phase a.c.; in that case voice-frequency current control must be used and its application is discussed in detail. Some actual cases on French railways are quoted. T.Horrocks

621.398 : 621.389

BIOMEDICAL MEASURING CIRCUITRY. See Abstr. 4382

621.398 : 621.389

PHYSIOLOGICAL TRANSDUCERS FOR MEASUREMENTS IN SPACE VEHICLES. See Abstr. 4388

621.398 : 621.396.2

PARAMETERS AND TECHNIQUES APPLICABLE TO ULTRA-LONG-RANGE COMMUNICATION WITH SOLAR SYSTEM PROBES. See Abstr. 4434

COMPUTERS . APPLICATIONS

(Refer also to Digital circuits . Switching circuits)

681.142

4571 MAN–COMPUTER SYMBIOSIS. J.C.R.Licklider.
I.R.E. Trans Human Factors Electronics, Vol. H.F.E.-1, 4-11 (March, 1960).

Man–computer symbiosis is an expected development in co-operative interaction between men and electronic computers. It will involve very close coupling between the human and the electronic members of the partnership. The main aims are (1) to let computers facilitate formulative thinking as they now facilitate the solution of formulated problems, and (2) to enable men and computers to co-operate in making decisions and controlling complex situations without inflexible dependence on predetermined programmes. In the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routine work necessary to prepare the way for insights and decisions in technical and scientific thinking. Preliminary analyses indicate that the symbiotic partnership will perform intellectual operations much more effectively than man alone can perform them. Prerequisites for the achievement of the effective, cooperative association include developments in computer time sharing, memory components,memory organization, programming languages, and input and output equipment.

681.142

4572 INTERPOLATOR OF THE SECOND ORDER FOR DIGITAL PROGRAMME CONTROL. V.V.Karibskii.
Priborostroenie, 1959, No. 6 (June). In Russian. English translation in: Instrum. Constr., 1959, No. 6, 7-11 (June).

Describes an arrangement for a simple digital parabolic interpolator, i.e. one solving a difference equation with constant second difference, $\Delta^2 y$ or $\Delta^2 x$ = constant. A.O.Stanesby

681.142 : 621-52

4573 A NOTE ON THE USE OF LOGICAL COMPUTERS TO DETERMINE THE MOST EFFICIENT METHOD OF USING FACTORY MACHINES. A.Rose.
Proc. Cambridge Phil. Soc., Vol. 56, Pt 2, 186-8 (April, 1960).

An extension of the previous work (Abstr. 6432 of 1958) on the McCallum and Smith type (Abstr. 3719 of 1951) of logical machine shows firstly that the number of decision elements required to solve a problem can be very much reduced by dividing the scanning process into two parts, the results of the first of which are recorded on a magnetic drum. The decision elements used for the first part of the process are thus made available for re-use during the second part. Secondly, in applying the machine to an (idealized) production control problem,it is now shown how to take into consideration a case in which it is of importance that particular jobs must be finished by certain machines by certain times, the costs of delays beyond these time bearing given linear relationships to the cost of overall delay. G.A.Montgomerie

681.142 : 621.374.32

4574 USE OF HIGH-SPEED DIGITAL COMPUTERS TO STUDY PERFORMANCE OF COMPLEX SWITCHING NETWORKS INCORPORATING TIME DELAYS. Y.N.Chang and O.M.George.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 982-7 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

In a relay system in which time delays may be associated with the closing or opening of some of the contacts, the system is described by a set of switching functions, one for each relay coil, in which the contacts are represented by the identification number of the corresponding relay. Bars represent normally-closed contacts, and opening and closing time delays by subscripts and superscripts respectively, e.g.

$$F_{1011} = (1001) + (1012) + (\overline{1004})\,(1012_{o}^{5}).$$

A computer programme is then used to examine the time history of the circuit under specified input conditions and to print out either the state at successive times or alternatively whether certain state specifications at particular times are met. With a 32 768-word IBM704, a network of 3000 elements can be solved at 7000 states/min. G.A.Montgomerie

681.142

4575 RIPPLE-TYPE TIME-DELAY NETWORKS USING ELLIPTIC FUNCTIONS. J.R.Kiseda and D.J.Ford.
Trans Amer. Inst. Elect. Engrs I,Vol. 78, 996-1002 (1960) = Commun. and Electronics, No. 46 (Jan., 1960).

Analytical methods are discussed for synthesizing time-delay analogues of the Pade approximation type. By identifying the transfer function required with an elliptic function a useful design parameter is obtained. Second-and fourth-order systems are dealt with in detail and responses are given. Two appendices determine the boundary conditions for coefficients. K.C.Garner

681.142

4576 ANALOGUE COMPUTER TECHNIQUES.
I. THE SOLUTION OF SIMULTANEOUS EQUATIONS, EIGENVALUE PROBLEMS AND POLYNOMIAL EQUATIONS.
II. AN APPROXIMATE METHOD FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS.
III. THE SIMULATION OF TRANSPORTATION DELAY AND ITS USE IN CONTROL SYSTEMS. F.C.Harbet.
Electronic Engng, Vol. 32, 74-7 (Feb.); 166-7, 167-9 (March, 1960).

681.142 : 518

4577 "LĪLĀVATĪ" — A NEW ANALOGUE COMPUTER FOR SOLVING LINEAR SIMULTANEOUS EQUATIONS AND RELATED PROBLEMS. I. GENERAL PRINCIPLES AND DESIGN OF MODEL I. G.N.Ramachandran and E.V.Krishnamurthy.
Proc. Indian Acad. Sci. A, Vol. 48, No. 3, 152-64 (Sept., 1958).

Describes a resistive passive-network computer, its operation and application. K.C.Garner

681.142

4578 ANTICIPATORY DISPLAY DESIGN THROUGH THE USE OF AN ANALOG COMPUTER.
L.J.Fogel and M.Dwonczyk.
I.R.E. Trans. Aeronaut. Navig. Electronics, Vol. ANE-6, No. 4, 228-39 (Dec., 1959).

Modern high-performance aircraft currently are pressing the limitations of the human operator. The increased speeds compress the allowable reaction time to such levels wherein logical decisions, and even conditioned reflex actions, may no longer be possible. The only way to overcome this human limitation of manned aircraft performance is through the incorporation of anticipatory displays; displays which offer a prediction of the various parameters so that the human operator is projected ahead of the system. An aircraft was analogue-computer-simulated, data reduction was programmed and the same computer was used to allow biophysical measurement, which furnished correlative measure. The effectiveness of various piloting techniques, as well as prediction intervals, was explored, The results indicate a first approximation to the design of improved displays through the use of anticipatory information.

681.142

4579 PRINCIPLES AND APPLICATIONS OF A CONTROL SYSTEM SIMULATOR. K.C.Parton and D.R.Roberts.
G.E.C. J., Vol. 26, No. 4, 163-72 (Autumn, 1959).

Electronic analogue techniques are briefly described and some typical simulation studies are discussed with circuit diagrams and some general results. Systems included are: (1) a capacitor charging system; (2) d.c. motor speed-control; (3) turbo-alternator voltage control; and (4) ship propulsion. K.C.Garner

681.142

4580 BOOSTING FUNCTION GENERATOR OUTPUT WITH TRANSISTORS. D.R.Chick.
Electronics, Vol. 33, No. 13, 75-6 (March 25, 1960).

Linear-segment approximation circuits using diodes not followed by a d.c. amplifier are not usually useful since the output signal is normally many times less than the input. In the circuit discussed transistors effectively replace the diodes to produce a useful output. K.C.Garner

681.142 : 621.398

4581 A TRANSFER FUNCTION COMPUTER. J.Brown.
National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 168-75.

This computer operates on signals of a random nature. Experiments are described in which a random noise source was used as a driving function. The device utilizes a cross-spectral analysis technique with post-spectrum-analysis cross-multiplication in order to allow the computer to work in an unfavourable signal-to-noise environment. It is thus possible to correlate the output signal to any one of several possible input sources. For the most part standard analogue-computer components are used. S.C.Dunn

681.142 : 621.391.822

4582 AUTOMATIC DISPLAY OF NOISE SUPPRESSION FACTOR. J.Tamiya.
Electronics, Vol. 33, No. 6, 55-7 (Feb. 5, 1960).

The circuit described is essentially an analogue ratio computer, which compares the amplitudes of two time-varying signals. Signal

A is periodically sampled and is converted into a trailing ramp which has an initial amplitude equal to the signal at the sampling instant, and a negative slope proportional to the sampled amplitude. Thus the triangle so formed has a constant base length for all amplitudes. Signal B is clamped at the sampled amplitude for a time equal to the triangle base length for signal A. It is arranged that signal A is always greater than signal B, so that if the triangular and square waveforms are superimposed, the point at which they cross is a measure of amplitude ratio in terms of time. Methods are described for providing this information as a c.r.o. display.

K.C.Garner

681.142

4583 DIRECT METERING FOR A TRANSFORMER ANALOGUE COMPUTER. J.F.Young.

Electronic Engng, Vol. 32, 280-8 (May, 1960).

Computer voltages are phase-shifted and added together by amplifiers and the resultants are supplied to adjustable gain amplifiers. These feed power amplifiers with current feedback which control ammeters and wattmeters. Constant-resistance phase-shift networks are used with a wattmeter to measure reactive volt-amperes. A calibrated phase-shifter is used for phase measurements.

681.142 : 518

4584 USE OF AN ELECTRONIC ANALOGUE COMPUTER WITH RESISTANCE NETWORK ANALOGUES. I.C.Hutcheon; J.P.K.Altes, L.Dekker and H.P.J.Gilissen.

Brit. J. appl. Phys., Vol. 10, No. 12, 542-3 (Dec., 1959).

A written discussion concerning a previous paper (Abstr. 3909 of 1960). Points are raised dealing with drift errors due to switch leakage and other effects in the analogue memory circuits. The authors of the original paper give the data required in a formal reply.

K.C.Garner

681.142

4585 ANALOGUE DEVICES AND THEIR USE IN INDUSTRY. P.Coroller.

Bull. Assoc. Suisse Elect., Vol. 51, No. 9, 461-5 (May 7, 1960). In French.

A general idea of the nature of simulator techniques is given. The question of accuracy is considered briefly. Some specific applications are described in conclusion.

A.E.I. Research Laboratory

681.142 : 621.317.39 : 539.1.07

4586 A 2000-CHANNEL ANALYZER FOR NEUTRON SPECTROSCOPY. J.Hahn and W.W.Havens, Jr.

Rev. sci. Instrum., Vol. 31, No. 5, 490-500 (May, 1960).

A 2000 channel time-of-flight analyser for neutron spectroscopy is described. The analyser is designed for use with pulsed accelerators operating at approximately 60 c/s. Channel widths of 0.1 μsec and a dead time of 0.8 μsec are obtained. A fast electrostatic memory is used to record data with a minimum of dead time, and a slower larger capacity magnetic drum memory is used to read out the electrostatic memory and accumulate data between bursts. The electrostatic memory system which was developed at Columbia University is described in detail.

681.142 : 621.398

4587 AN AUTOMATIC INSTRUMENTATION ANALOG DATA PROCESSING SYSTEM. E.G.Hoefs and N.F.Bolling.

National Telemetering Conference, Denver, Colorado, 1959 (See Abstr. 4929 of 1959) p. 247-52.

The system provides means of receiving, storing and displaying telemetered data and permits the playback of airborne- or ground-recorded magnetic tape. It automatically corrects the major data recording and transmission errors and it automatically produces analogue-time history plots of the data. It will permit simultaneous flight operations on six test vehicles. The major features of the facility are: automatic f.m.–f.m. data acquisition and processing correction equipment; automatic p.d.m. data acquisition and processing correction equipment, in addition to the inherent p.d.m. correction features; automatic establishment of scale zero and sensitivity coefficients for visual display and analogue plotting; unique optical devices incorporated in oscillographic recorders to permit photographic titling, scaling, trace identification and printing of grid and time lines simultaneous with the recording of data traces.

S.C.Dunn

681.1±2 : 621.394.3

SIMULATION OF DATA-SWITCHING SYSTEMS ON A DIGITAL COMPUTER. See Abstr. 4402

681.142 : 621.389

USE OF ELECTRONIC COMPUTERS IN MEDICAL DATA PROCESSING: AIDS IN DIAGNOSIS, CURRENT INFORMATION RETRIEVAL, AND MEDICAL RECORD KEEPING. See Abstr. 4390

681.142 : 621.313.333

A COMPUTER METHOD OF DETERMINING THE VARIATION OF INDUCTION MOTOR MAGNETISATION WITH SPEED. See Abstr. 3972

681.142 : 621.389

AUTOMATIC READING AND RECORDING OF DIGITAL DATA IN THE ANALYSIS OF PRIMATE BEHAVIOUR. See Abstr. 4378

MECHANICAL AND CIVIL ENGINEERING TECHNOLOGY

MATERIALS . TESTING

620.178.5

4588 HIGH INTENSITY SWEPT FREQUENCY ACOUSTIC TEST EQUIPMENT FOR THE 1 TO 60 kc/s RANGE. D.J.Birchall.

Electronic Engng, Vol. 32, 202-8 (April, 1960).

Describes the control gear for a high-intensity, swept-frequency siren and the instrumentation designed for measuring sound pressure levels, and comprising low noise pre-amplifiers, band-pass selective amplifiers, and logarithmic amplifiers. This siren is housed in an anechoic chamber, and the whole equipment is used to carry out acoustic tests of various descriptions. The main feature of interest is the method of employing thermistors as the frequency controlling elements whereby the siren and selective amplifiers track with a frequency reference. The selective amplifiers are thereby tuned to the fundamental frequency of the sound field, and track together when the frequency reference is swept, thus providing a system for automatic swept-frequency monitoring on narrow-band channels. Frequency range of the equipment is 1 to 60 kc/s, covered in one sweep without range switching, at a maximum rate of two octaves/minute. Threshold sensitivity for sound measurements is about 70 dB, and dynamic range of the logarithmic amplifiers is 60 dB.

620.179.1

4589 CHOICE OF FREQUENCY FOR EDDY-CURRENT TUBE TESTING. F.R.Bareham.

Brit. J. appl. Phys., Vol. 11, No. 6, 218-22 (June, 1960).

Eddy-current testing can be used to detect faults in metal tubes by passing the tube through a pair of short solenoidal coils which are energized by an alternating current. The decrease in density of the induced eddy-currents from the outer surface is determined by the frequency of the energizing current and by the electrical properties and dimensions of the tube. Since the eddy-currents flow in a circumferential direction, their distribution is not, as often assumed in the past, the same as when current flows in the direction of the axis. The distribution of eddy-currents flowing circumferentially is given in general terms for non-magnetic tubes and the results can be used in conjunction with a nomogram to determine suitable frequencies for many practical applications.

620.19 : 539.21

4590 THE APPLICATION OF IRRADIATION IN INDUSTRY. M.C.Crowley-Milling.

Proc. Instn Elect. Engrs, Paper 3145 U, publ. Oct., 1959 (Vol. 107A, 111-123, 123-6, April, 1960).

Republication, with discussion, of the paper already abstracted as Abstr. 614 of 1960.

LIST OF JOURNALS

Astron. J.
Astronomical Journal — Publisher changed to: American Institute of Physics, 335 East 45th Street, New York 17, N.Y., with Vol. 65, No. 1, February, 1960.

Bull. Soc. Roy. Belge Elect.
Bulletin de la Société Royale Belge des Electriciens (Formerly: Bulletin de la Société Belge des Electriciens [Bull. Soc. Belge Elect.]) — 1 Place du Trône, Brussels.

Feinwerktechnik
Feinwerktechnik — Article reprinted in: Entwicklungsberichte der Siemens und Halske Aktiengesellschaft [Entwicklungsber. Siemens und Halske].

Glass Technol.
Glass Technology — Society of Glass Technology, Thornton, Hallam Gate Road, Sheffield 10.

J. Assoc. Appl. Physicists (India)
Journal of Association of Applied Physicists — 92 Upper Circular Road, Calcutta 9.

Przeglad telekomun.
Przeglad Telekomunikacyjny — Subscription address: Centrali Kolportazu Prasy i Wydawnictw "Ruch", ul. Srebrna 12, Warsaw.

Rep. Govt Industr. Res. Inst.
Reports of the Government Industrial Research Institute, Nagoya — Hirate-machi, Kita-ku, Nagoya.

Rev. A
Revue A.— Presses Académiques Européennes, 98 chaussée de Charleroi, Brussels 6.

NEW JOURNALS

A.E.I. Engng Rev.
A.E.I. Engineering Review — Associated Electrical Industries Ltd., 33 Grosvenor Place, S.W.1. Vol. 1, No. 1 dated May, 1960. Replaces: B.T.H. Activities [B.T.H. Activ.] Metropolitan-Vickers Gazette [Metropolitan-Vickers Gaz.] Siemens Edison Swan Journal [Siemens Edison Swan J.] and Distribution of Electricity.

Przeglad Elektron.
Przeglad Elektroniki — Subscription address: Przedsiebiorstwo Kolportazu Wydawnictw Zagranicznych "Ruch", ul. Wilcza 46, Warsaw. Vol. 1, No. 1 dated 1960.

CHANGE OF TITLE

B.T.H. Activ.
B.T.H. Activities — Replaced after Vol. 30, No. 7, 1960, by: A.E.I. Engineering Review [A.E.I. Engng Rev.].

Bull. Soc. Belge Elect.
Bulletin de la Société Belge des Electriciens — Title changed to: Bulletin de la Société Royale Belge des Electriciens [Bull. Soc. Roy. Belge Elect.] with issue dated October-December, 1959.

Metropolitan-Vickers Gaz.
Metropolitan-Vickers Gazette — Replaced after No. 486, 1960, by: A.E.I. Engineering Review [A.E.I. Engng Rev.].

Siemens Edison Swan J.
Siemens Edison Swan Journal — Replaced after Vol. 1, No. 3, 1959, by: A.E.I. Engineering Review [A.E.I. Engng Rev.].

Abstracts of articles from the following journals have been reprinted, with kind permission, from "Mathematical Reviews", and the addresses are not available at present.

Acad. R.P. Romine Bul. Sti. Sect. Sti. Mat. Fiz.
Academia Republicii Populare Romine Buletin Stiintific. Sectiunea de Stiinte Matematice si Fizice.

Arch. Mech. Stos.
Archiwum Mechaniki Stosowanej.

Arch. Rational Mech. Anal.
Archive for Rational Mechanics and Analysis.

Bull. Soc. Math. France
Bulletin de la Société Mathématique de France.

Com. Acad. R.P. Romine
Comunicările Academiei Republicii Populare Romîne.

J. Aero. Sci.
Journal of the Aeronautical Sciences.

J. Aero/Space Sci.
Journal of the Aero/Space Sciences.

J. Math. Mech.
Journal of Mathematics and Mechanics.

J. Reine Angew. Math.
Journal für die Reine und Angewandte Mathematik.

Rev. Acad. Ci. Madrid
Revista de la Real Academia de Ciencias Exactas, Fisicas y Naturales de Madrid.

Tensor (N.S.)
Tensor. New Series.

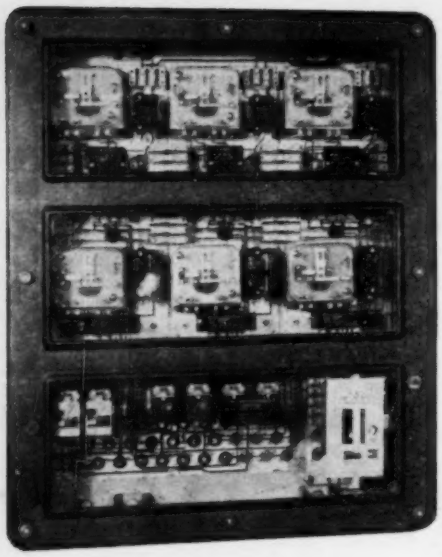
Teor. Veroyatnost. i Primenen.
Teoriya Veroyatnostei i ee Primeneniya.

Voprosy Kosmog.
Voprosy Kosmogonii.

ERRATA

Abstr. 2375 (1960) line 3: for "Vol. 20" read "Vol. 90".
Abstr. 2691 (1960) line 3: for "N.Narbut" read "P.Narbut"
Abstr. 2714 (1960) line 3: insert "In French" at end of journal reference.
Abstr. 2840 (1960) line 3: for "(Feb., 1960)" read "(Dec., 1959)".
Abstr. 3108 (1960) line 3: for "H.Owyang" read "G.H.Owyang".

AUTHOR INDEX



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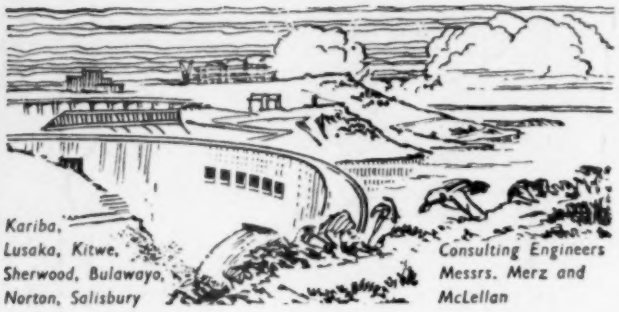

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